FISH, WILDLIFE AND PETROLEUM PRODUCTION THE GULF OF ALASKA

FISH AND WILDLIFE RESOURCES

APPENDIX 5 — THE FISHERY RESOURCES OF THE GULF OF ALASKA

GULF OF ALASKA OPERATORS COMMITTEE

THE FISH AND WILDLIFE RESOURCES OF THE GULF OF ALASKA

FISHERY RESOURCES OF THE GULF OF ALASKA

APPENDIX 5

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INTRODUCTION

Alaska's commercial fisheries provide substantial tax revenue for the state, and provide employment for more than 14,000 persons in the Gulf of Alaska alone.

The following is intended to serve as a historical digest of U.S. commercial fishing efforts in the Gulf of Alaska, and to describe highlights of recent fishery trends. The factors which have been identified as specific causes of increase or decline in the availability or harvest of a particular marine species, or of the total fishery resource in the Gulf of Alaska, can be divided generally into two groups—environmental and human.

Although the information contained here indicates the variety, nature and number of environmental factors which bear on the productivity or availability of the fish and shellfish resources of the Gulf of Alaska, many environmental factors are not easy to identify. However, environmental phenomena which have been directly related to the marine species of the Gulf of Alaska include: failure of a given species to appear in normal harvest areas despite favorable indications of abundance during the previous year; unexplained, long-range declines in harvestable numbers of major fish species; off-year salmon cycles; and unexpectedly heavy runs of salmon overwhelming processing facilities. To these can be added more conspicuous environmental phenomena such as disease, storms, and earthquakes.

At the same time, there are many human factors which bear strongly on the availability, harvest and packing effort related to the fishery resources of the Gulf of Alaska, including: the lack of adequate processing facilities to cope with unexpectedly massive landings of certain species, the influence of foreign fisheries on the U.S. harvest, the possibility of overharvest of some species in some areas, the discovery of new areas from which certain species can be taken, the recognition of new resources (shrimp), but failure to develop the resource harvest to its fullest potential, ex-vessel prices, wage disputes, and new state and federal regulations governing harvest areas, types of equipment and seasons.

In summary, many natural and human phenomena strongly influence the degree to which any given species may be harvested and/or processed during any given year. Therefore, any influence which may accrue to fish or shellfish resulting from the presence of human activities in the Gulf of Alaska must be related to those species on the basis of long-term trends. This will tend to cancel out those factors which may occur infrequently, but which may be dramatic at the time of the occurrence.

1944

There was a decrease by 6 percent in volume and 1 percent in value of catch from 1943. Red and pink salmon decreased while catch of herring increased. There were only small runs of pink salmon in the Icy Strait, western, and eastern districts due to poor stream survival of the young under severe winter conditions of the previous year. There were large catches of chum salmon especially in the Prince William Sound area.

Shellfish landings increased primarily due to increases in dungeness crab and shrimp production. Two-thirds of dungeness crab production came from the central Alaska area.

1945

Total catch increased by 6 percent in volume and 9 percent in value from 1944, mostly attributed to increased landings of herring and salmon. A near record pack of salmon in Prince William Sound reflected the unusual abundance of pink and chum salmon. Due to unfavorable weather conditions, runs of chum salmon in southeastern Alaska were very small. The red salmon runs and escapements in Cook Inlet and Kodiak areas were generally fair.

Dungeness crab and shrimp catches increased for the second consecutive year.

1946

The poor catch of salmon (smallest since 1927) was offset by the largest herring catch on record explaining the increase of total catch by 9 percent in volume and 10 percent in value from the previous year. Runs of pink salmon in the southeastern district were small. Observers reported unusually heavy predation kills of salmon in the smaller streams of the district. An excellent run of king salmon occurred in the Situk area and escapement was the best in eight years. Cook Inlet district pack of king salmon fell below average by one-third, largely as the result of a labor dispute over fish prices during the first two weeks of the season rather than because of the smaller run.

Oyster production was confined to the Ketchikan area of the southeast. Shellfish production increased by 1.4 million pounds due to increases in dungeness crab, shrimp and razor clam landings.

1947

This year's catch declined by 6 percent in quantity and 1 percent in value from 1946. Salmon, herring and sablefish landings decreased. The halibut fishery operated without price or allocation controls. In southeastern Alaska, pink salmon runs were poor. The much later opening of the season protected the early runs and permitted them to reach the spawning grounds thus escaping the fishery. Razor clam landings decreased due to price disagreement.

1952

The commercial fishery catch continued to decline, by 8 percent in quantity and 5 percent in value compared with 1951.

For the second year in a row, herring were not available to the Kodiak fishery, and were not in good supply in the Prince William Sound area.

The salmon catch increased by more than 6 million pounds compared with 1951, largely in western and central Alaska. There was a sharp decline in southeastern Alaska catches. Pink, silver, and chinook salmon catches declined, but sockeye and chum catches were up substantially. Exploratory work revealed commercial quantities of shrimp in the Glacier Bay region and in other areas of southeastern Alaska.

1953

The commercial harvest of fishery products continued to decline in 1953, down more than 77 million pounds and nearly 11 million dollars.

The canned salmon pack of nearly 2.9 million (48 pound) cases was the lowest since 1921. The 1953 failure resulted from a scarcity of fish while the low pack was attributed to adverse economic conditions. The near collapse of the fishery was indicated by the western Alaska 1953 red salmon pack, 815,000 cases less than in 1948. Although not regarded as a red salmon district, the pack of red salmon in southeastern Alaska was the only noteworthy gain during the year. Cook Inlet production was only fair, and the Prince William Sound fishery was a near failure. Late in 1953, the shortage of fish resulted in many of the leading packers requesting the U.S. Fish and Wildlife Service to implement drastic gear curtailments in all Alaska. This led to major efforts by the Branch of Alaska Fisheries and the U.S. Fish and Wildlife Service to return the salmon fishery to its former productivity.

The halibut season, May 17 to June 9, was the shortest season on record for the area.

Shrimp exploration was conducted at Yakutat Bay, offshore salmon resources were investigated both north and south of the Aleutian Islands, and herring investigations were carried out during the fall in Prince William Sound. Only two significant schools of herring were located in Prince William Sound during the year.

1954

The commercial harvest of fishery products increased by 41 million pounds (14 percent) in quantity and 4.8 million dollars (18 percent) over 1953. Southeastern Alaska recorded a 53 percent gain during the year, largely in packs of chum and pink salmon. The western Alaska canned salmon pack was 26 percent below 1953, with the Bristol Bay area suffering most due to an off-cycle year and a large reduction in fishing effort. In central Alaska, the Kodiak district contributed more to the 1954 salmon pack than any year since 1947, and Cook Inlet experienced an outstanding season.

Biological research centered on pink salmon in southeastern Alaska, red salmon in the Cook Inlet, Kodiak and Bristol Bay areas, and herring in southeastern Alaska and Prince William Sound.

1957

The overall commercial fishery continued to decline, with a decrease of 13 percent in volume and 16 percent in value below 1956. Catches of chinook, chum, and silver were above 1956, but the total catch was 25 percent less due to a sharp decrease in landings in both pink and red salmon.

Increases in the catches of herring, sablefish, and king crabs were reported but there was an abrupt drop in the dungeness crab harvest and lower landings of both halibut and shrimp.

The poor salmon harvest in 1957 resulted from the universally low level of pink salmon runs throughout Alaska. The red salmon catch also failed on the Nushagak River, the False Pass catch was poor, and abundance was off at Port Moller. The normally stable Cook Inlet produced only half the normal pack of reds for the first time in many years.

During the year there was serious concern over the apparent depletion of some salmon runs, notably in Bristol Bay. It was considered that heavy fishing by a Japanese high seas fleet west of 175 West longitude was responsible for the decline since the Japanese intercepted an enormous run of red salmon in that area taking about 10 million fish during a ten-day period. In view of the situation, the American section of the International North Pacific Fisheries Commission proposed establishment of a zone of cessation in which there would be no fishing by treaty nations in the waters where salmon of American origin have been found in significant numbers. The move was not accepted by the Japanese at the North Pacific Treaty meeting in 1957.

The herring fishery continued its upward trend, with a harvest greater than 118 million pounds.

The halibut season was less productive than the previous year despite a longer season. The species was not as abundant as in 1956, although there was no actual scarcity of fish. The market generally was attractive but prices disappointing.

The crab industry continued to expand. The promising shrimp industry continued to be limited by economic rather than biological factors. Although a small shrimp catch was made in Cook Inlet, southeastern Alaska continued to be the major producer. Razor clam production held at about the average of recent years.

1958

Alaska experienced the largest catch of pink salmon since 1951 and the smallest of red or sockeye since full scale canning of these fish began.

The total fishery catch was up by 8 million pounds over the previous year and the value increased by 2 million dollars.

The large run of pink salmon occurred all along the Alaskan coast, with the central section accounting for the largest share, followed by southeastern Alaska. An unusually large run of pinks took place in western Alaska, and the pack of fish in that area was the largest since 1920. Red salmon were down sharply in all areas, a decline believed due to Japanese offshore operations, which continued to take a heavy toll of the red salmon destined for Bristol Bay.

Alaska was second in fishery production on the Pacific Coast, with a catch of 358 million pounds of fish and shellfish valued at 41 million dollars.

Western and central Alaska experienced a successful salmon season, and were largely responsible for the 40 percent increase in volume and 60 percent increase in value of the salmon pack, with a gain of 793,000 cases over the previous year. Red salmon returned to Bristol Bay in near record numbers in 1960 with the total run estimated at well over 35 million fish.

Central Alaska salmon fishing along the Alaska Peninsula, Kodiak Island and in Cook Inlet was better than expected in 1960. However, fishing was poor in Prince William Sound. In southeastern Alaska all salmon species were scarce.

Catches of king crab increased from nearly 19 million pounds in 1959 to 29 million pounds in 1960, and the canned pack of this product increased by 81 percent, from 55,000 cases in 1959 to 100,100 cases in 1960. Three factors were responsible: the discovery of new fishing grounds and excellent fishing on the usual grounds; an increased number of crab canneries; and a growing consumer acceptance of king crab products over wide areas of the United States.

1961

The 1961 Alaska fish and shellfish harvest, 413 million pounds valued at 46 million dollars, was second high in Pacific Coast volume with 35 percent of the volume and 36 percent of the value.

In value of processed fishery products, Alaska was second on the Pacific Coast with 32 percent of the total. Alaska showed the greatest percentage gain with the value of its processed products, due primarily to increased packs of canned salmon, shrimp and crabs. Salmon landings (265 million pounds) were the largest since 1956 and their value (36 million) was a record.

In central Alaska, salmon fishing along the Alaska Peninsula and Kodiak Island was about the same as in 1960. However, a completely unexpected heavy run of pink salmon occurred in Prince William Sound.

In southeastern Alaska, the runs of pinks and chums in Icy Strait and adjacent waters were substantial in number of fish and the duration of the runs. Many vessels not normally fishing these waters moved to the area when the magnitude of the run became known.

Shrimp production took a phenomenal jump in 1961, with a 68 percent increase over 1960. Alaska and Oregon registered large increases, more than doubling the 1960 total. Prices, however, did not keep pace, except in Alaska, and the total value of this fishery was only 41 percent above the previous year's total.

King crab production established a new landings and canned pack record in 1960. Landings of dungeness crabs climbed over the entire range, and prices increased considerably in most areas.

During the height of the Icy Strait pink salmon run, the Alaska Department of Fish and Game permitted fishing for 24 hours on alternate days, a move designated essentially to allow time to process all fish while in prime condition and to provide an opportunity for effective distribution of escapement during the run.

Coho salmon landings in Alaska were up by 2.3 million pounds over the previous year—the gain occurring in all three fishing regions.

During the October spawning period, sockeye salmon suffered heavy losses from *Columnaris* infection, with some streams losing as much as 90 percent of the spawning runs. A large number of spawners and abnormally warm waters were suggested as possible factors.

The Alaskan halibut catch was down by 6 million pounds from 1962, with price disagreements and lower ex-vessel prices, adverse weather, and fewer fish contributing to the decline. Of these, the lower prices, with a corresponding reduced effort, were believed to be the major cause.

The herring catch, used entirely in the manufacture of fish meal and oil or as bait, amounted to 31 million pounds, 8 percent less than 1962, and the smallest since 1917.

Alaska lead all other Pacific Coast states in crab landings with 90.8 million pounds worth 9 million dollars—87 percent of the volume and 75 percent of the value. King crabs accounted for most of the crab landings. During the period 1959-1963 king crab landings increased an average of nearly 50 percent each year.

Dungeness crab landings increased by 3 million pounds over 1962. The Alaska crab industry experienced the strong demand for fresh frozen crab meat due to the reduced availability of dungeness crabs on the Oregon and California coasts. Prices for fresh crabs were so strong that canning was virtually suspended.

The shrimp catch exceeded 14 million pounds—about 2.5 million pounds less than in the previous year. The total domestic catch (all U.S.) was a record of 507 million pounds. This greater supply was possibly responsible for a decline of about 25 percent in the average price paid to fishermen.

1964

The Alaska commercial fishery ranked second on the Pacific Coast in volume (492.6 million pounds) and first in value (56 million).

Several events profoundly affected processing in the Pacific Coast states during the year. The earthquake in Alaska destroyed or severely damaged king crab and razor clam canning facilities, thus reducing the pack of these items.

The canned salmon pack in Alaska was nearly 900,000 cases more than in 1963, caused by sharply increased runs of chum, pink and red salmon.

The decline of the king crab pack by 20,000 cases resulted principally from the Good Friday earthquake, which destroyed or extensively damaged crab processing facilities. Three canneries were a total loss, and several others were temporarily out of operation. Although Alaska had been steadily increasing its harvest of dungeness crabs, the earthquake curtailed operations in 1964.

Landings of dungeness crabs were 3.8 million pounds below the previous year, a decline caused principally by a shift to the king crab fishery.

The shrimp industry made a reasonably strong comeback since the 1964 earthquake, with two plants in Kodiak and two in Wrangell canning shrimp in 1965.

Despite a small increase in 1965, clams appear to be disappearing from the Pacific Coast. The decline can be attributed to increasing numbers of recreational diggers, high cost of production, destruction of the Alaska razor clam industry and resource in 1964, and failure of Alaska razor clams to reach their previous abundance.

The king crab pot limit of 30 per boat in Alaska was lifted in 1965. The use of trawls, however, for taking king crabs, was prohibited in all areas.

In 1965, the Japanese operated 700 vessels in the north Pacific and Bering Sea in waters off the Alaska coast, the same as the previous year. The fleet was composed of 27 shrimp vessels, 68 fish meal vessels, 12 halibut, 12 crab vessels, 380 salmon vessels and 201 miscellaneous ships.

1966

There were 333.3 million pounds of Alaska salmon landed in 1966, the largest since 1949, but only 52 percent of the record 643.7 million pounds in 1936. Total Alaska landings were 46 percent of quantity and 48 percent of value of Pacific Coast fisheries. Alaska ranked first in value of catch in all states with total catch worth 80.7 million dollars. The southeastern region led in total production followed by central and western regions. Pink, chum, and red salmon showed increases in both southeastern and central regions. Pink salmon catch in both regions increased by almost 80 million pounds. Red salmon fisheries that were concentrated primarily in Egegik and Kuichak areas of Bristol Bay increased harvest by 3.9 million pounds. Southeastern Alaska experienced a good late run of chum salmon showing a gain of 13.1 million pounds in this area.

King crab landings continued a phenomenal growth that began during the last decade. This species ranked second to salmon as the most important Alaska fishery resource. The Kodiak Island, followed by the Aleutian Islands, are the leading producing areas of king crab.

Shrimp landings increased by 11.3 million pounds from the previous year. Exploratory fishing revealed such a large concentration of side-stripe shrimp in the Kodiak area that a possibility for a year-round fishery of this species may be developed.

1967

With fishery landings valued at 47 million, Alaska ranked third in the States in 1967. In volume of landings, Alaska, with 370 million pounds, also ranked third nationally.

Kodiak, Alaska, ranked as the third most important fishing port in the United States, with nearly 10 million dollars in fishery landings made in Kodiak during the year.

The king crab fishery continued to decline, with 85 million pounds landed in 1968. The catch from Kodiak and other areas was sharply reduced. The price for the scarce king crab soared to as high as 48 cents per pound, four times greater than the contract price of 12 cents. The shortage in king crab created interest in the tanner or snow crab, a species plentiful in Alaskan waters. Consequently, over 1,000 cases of tanner crab were packed in 1968.

With a decline in the king crab catch, a healthy market was created for dungeness crabs, a species which produced a bumper crop during the year.

1969

Alaska lead all states in the value of the fish and shellfish harvest, at 71.1 million dollars, and ranked third in all states in the volume of catch, with a harvest of 346.8 million pounds.

The 1969 Pacific salmon catch was 25 percent less than in 1968, but Alaska accounted for 89 percent of the volume and 87 percent of the value of the pack. There were excellent pink salmon runs in the Kodiak area, and the Bristol Bay red salmon catch, although reduced by a labor dispute at the start of the season, was greater than 1968.

The Pacific halibut catch exceeded the 1968 season by 9.5 million pounds. Unlike 1968 when low ex-vessel prices discouraged fishing for halibut, average prices paid the fishermen increased by over 50 percent, attracting more fishing craft. Other factors contributing to the profitable 1969 season were very low storage holdings as the season opened and a ruling by the Food and Drug Administration prohibiting the market name of "Greenland Halibut" for a species often known as Greenland turbot.

A record catch of 47.8 million pounds of shrimp was reported from Alaska. The vast shrimp resource continued undeveloped despite the enormity of the resource.

The new sea scallop fishery experienced some difficulty in 1969. Landings of 1.7 million pounds of sea scallop meats were about the same as 1968. However, new state regulations closed some areas periodically during the year, fishing was reportedly not as good as in 1968, and there was a general decline in fishing effort.

In 1968-69, the Alaska Board of Fish and Game brought the king crab fishery under tighter control by establishing closed seasons. Despite poor fishing prospects, ten new large king crab vessels were added to the fleet in '69.

Landings of tanner crab in '69 totaled 10.2 million pounds compared with 3.2 million pounds in 1968.

Dungeness crab fishing in the Pacific northwest yielded a record catch of 49.1 million pounds. The declining king crab fishery created an excellent market for the species, and additional quantities were canned to make up for the decrease in the pack of king crabs.

1970

The total Pacific salmon catch was 396.7 million pounds—61 percent larger than the 246.2 million pounds taken in 1969 and the largest catch since 1949. Landings of all five species (king, chum, pink, red and silver) were larger.

Scallop landings were down 41% from 1970. Four vessels operated in the scallop fishery compared with seven in 1970.

1972

Pacific Coast shrimp landings of 106.0 million pounds worth $6.6 million constituted 28 percent of the volume and 3 percent of the value of the total U.S. shrimp harvest. Alaska led in volume with a near-record 83.8 million pounds.

Alaska salmon landings, among the smallest on record, were about 75 percent of the total Pacific salmon production. Landings of silver salmon increased slightly compared with 1971, but all other species declined markedly. Alaska red salmon landings were less than one-half the 1971 production and the third smallest harvest on record. A poor run of the Bristol Bay red salmon resulted in a pack of only 201,700 cases in that area—compared with 682,340 cases in 1971. Pink salmon runs at Prince William Sound and in the Kodiak area resulted in a total Alaska pack of only 538,111 cases of pink salmon—compared with 1,074,547 cases in 1971.

Total U.S. landings of crabs, all species, were 281.1 million pounds worth $58.6 million—a gain of 2 percent in quantity and 13 percent in value compared with 1971. The greater volume resulted largely from a record harvest of *snow* carbs and a small increase in landings of Alaska *king* crabs. A shortage of *dungeness* crabs, combined with a brisk market for this popular shellfish, caused the average price per pound to increase from 24 cents in 1971 to 44 cents in 1972.

Alaska halibut landings were about 86 percent of the total U.S. harvest—continuing the trend toward increased landings in Alaska ports. In 1972, fishermen received record ex-vessel prices for halibut—averaging about 65 cents per pound (dressed weight) compared with 32 cents per pound in 1971.

1973

For the second year, Alaska led all states in shrimp production with 119.9 million pounds—an all-time national record. Alaska shrimp fishermen were assisted in taking these phenomenal landings with the addition of at least 10 large Gulf of Mexico type double-rig shrimp draggers that fished in distant off-shore waters without quota limitations.

Salmon landings in Alaska declined sharply. The Alaska harvest of 136.4 million pounds was 16% less than in 1972 and one of the smallest on record. Alaska accounted for 65% of the total Pacific salmon harvest. The value of Alaska landings ($60.0 million) was $15 million greater than 1972.

The greater value reflected the swift increase in ex-vessel prices - some nearly double the prices paid in 1972. Alaska landings of pink, red, and silver salmon declined substantially. Fewer pink salmon were expected because of fluctuations in the two year life cycle in an odd year, but the runs of pink were unexpectedly low in the major producing areas. The red salmon harvest, also was much smaller than biologists had predicted. The Bristol Bay red salmon runs were the smallest on record.

Snow crab landings were a record 61.7 million pounds, more than double the 1972 harvest. This new fishery in Alaska has developed rapidly from the 7 million pounds taken in 1971. Improved processing techniques have created a good market as a substitute for the currently scarce dungeness and king crab meat and sections. King crab landings of 76.8 million pounds increased 2 million pounds compared with 1972. As a result of higher prices, fishing effort intensified in king crab

Table I-1
FISH & SHELLFISH LANDINGS IN ALASKA
1940 - 1974

Year	FISH		SHELLFISH		TOTAL	
	1,000 Lbs.	1,000 $	1,000 Lbs.	1,000 $	1,000 Lbs.	1,000 $
1940	561,140	10,458	2,548	154	653,688	10,612
1941	733,281	14,891	2,988	148	736,269	15,039
1942	519,680	17,827	2,500	107	522,179	17,934
1943	591,423	20,340	3,222	166	594,645	20,506
1944	557,234	20,229	3,965	185	561,199	20,414
1945	590,474	22,073	5,578	216	596,052	22,288
1946	644,491	24,232	6,955	390	651,446	24,622
1947	609,365	27,605	4,444	378	613,810	27,982
1948	559,464	30,979	7,436	516	566,900	31,495
1949	466,261	38,759	6,628	540	472,889	39,299
1950	472,221	30,562	10,072	810	482,293	31,372
1951	396,142	38,024	11,584	1,236	407,727	39,260
1952	364,390	36,168	9,794	1,070	374,184	37,238
1953	285,489	25,174	11,477	1,293	296,966	26,467
1954	323,260	29,770	14,369	1,481	337,629	31,251
1955	298,819	25,077	16,503	1,690	315,323	26,767
1956	413,229	36,072	14,917	1,667	428,146	37,739
1957	354,457	29,969	16,660	1,585	371,117	31,554
1958	357,986	31,804	21,100	1,392	379,086	33,197
1959	287,051	26,341	36,364	2,446	323,523	28,787
1960	316,419	37,796	41,294	3,138	357,713	40,934
1961	349,087	41,353	64,381	5,116	413,468	46,470
1962	350,205	50,149	79,013	7,093	429,218	57,242
1963	285,643	36,065	106,294	9,638	391,937	45,703
1964	385,002	45,953	107,611	10,062	492,614	56,015
1965	334,238	55,686	157,957	14,641	492,195	70,327
1966	388,396	62,605	193,274	18,113	581,670	80,718
1967	179,591	29,051	181,754	18,738	361,345	47,790
1968	307,255	51,500	142,486	27,604	449,741	79,093
1969	233,000	42,800	130,000	21,900	363,000	64,700
1970	381,000	77,000	152,000	20,500	535,715	97,500
1971	287,139	59,478	184,079	26,027	471,218	85,505
1972	227,254	58,879	195,224	33,551	422,478	92,431
1973	200,237	80,974	226,274	64,273	466,511	145,247
1974					456,864	141,120

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, C.F.S. No. 6400, March 1974, and C.F.S. No. 6700, March, 1975.[2]

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.[1]

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.[1]

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.[3]

Table I-2
ALASKA VOLUME & VALUE OF CATCH AND THE PERCENT OF U.S. FISH AND SHELLFISH HARVEST VARIOUS YEARS, 1940 - 1974

	VOLUME OF CATCH		VALUE OF CATCH	
Year	Million Lbs.	% Of U.S. Catch	Million $	% Of U.S. Catch
1940	564	14	10.6*	11
1950	482	10	31.4*	9
1960	358	7	40.9	12
1961	414	8	46.5	13
1962	429	8	57.2	14
1963	392	8	45.7	12
1964	493	11	56.0	14
1965	492	10	70.3	16
1966	582	13	80.7	17
1967	361	9	47.8	11
1968	434	11	71.6	15
1969	347	8	71.1	14
1970	529	11	89.7	15
1971	471	10	85.5	13
1971	471	10	85.5	13
1972	422	8.9	92	10
1973	466	9.0	145.2	16 (Prelim)
1974	457	9.2	141,120	16 (Prelim.)

**Does not include compensation for use of boats, gear, etc. that were added to the value starting in 1960.*

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

Table I-3
OPERATING UNITS
SOUTHEAST & CENTRAL ALASKA
1940-1971

	Southeast Alaska				Central Alaska			
Year	Fishermen On Vessels, Boats And Shore	Motor Vessels Number	Motor Vessels Tonnage	Motor & Accessory Boats	Fishermen On Vessels, Boats And Shore	Motor Vessels Number	Motor Vessels Tonnage	Motor & Accessory Boats
1940	9,553	536	10,033	-	6,956	237	6,126	-
1941	4,565	837	9,512	1,820	3,073	141	3,258	1,436
1942	4,888	733	7,446	1,512	2,572	105	1,644	1,453
1943	5,146	822	9,196	1,282	2,121	115	2,045	1,193
1944	4,916	910	9,775	1,537	1,979	142	2,437	1,220
1945	4,936	798	9,874	1,167	2,391	135	2,593	1,089
1946	5,435	893	11,086	1,350	2,687	230	3,738	1,528
1947	6,662	1,422	17,272	1,598	3,124	294	4,710	1,345
1948	6,682	1,466	17,585	1,567	3,014	297	5,374	1,406
1949	5,261	1,281	15,168	1,135	3,276	342	4,326	1,077
1950	6,094	1,417	16,756	1,497	4,056	443	7,162	1,412
1951	8,133	1,694	20,445	1,658	6,451	882	11,779	2,143
1952	7,601	1,591	19,914	1,495	4,048	506	6,587	1,419
1953	7,172	1,431	17,420	1,730	4,488	611	7,382	1,602
1954	6,507	1,334	16,067	1,667	4,528	603	7,866	1,656
1955	6,773	1,387	17,161	1,575	5,170	652	8,257	1,753
1956	5,496	1,291	17,945	1,370	5,686	630	8,570	1,528
1957	5,880	1,240	17,181	1,332	3,986	611	8,845	1,619
1958	6,377	1,257	18,763	2,046	3,823	702	9,104	1,535
1959	6,108	1,311	19,079	2,186	3,706	582	8,287	1,773
1960	6,033	1,397	29,432	1,792	5,511	717	14,241	2,561
1961	5,781	1,264	27,308	1,847	5,694	707	14,790	2,600
1962	5,336	1,276	28,926	1,540	6,185	829	21,088	2,850
1963	5,280	1,279	28,460	1,530	7,175	932	25,542	3,350
1964	5,980	1,150	27,318	1,600	6,360	771	22,246	3,480
1965	5,618	1,274	29,064	1,600	6,837	807	22,086	3,000
1966	6,250	1,267	28,964	1,700	7,031	918	26,179	3,200
1967	7,202	1,201	27,720	2,200	6,854	841	81,758	2,500
1968	7,545	1,031	25,097	2,215	8,054	1,408	42,440	3,404
1969	5,691	924	21,110	1,990	9,134	1,384	35,292	3,714
1970	7,100	1,445	27,892	2,011	11,178	1,819	46,993	4,379
1971	6,217	1,262	24,533	1,776	8,952	1,501	34,720	2,134

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States. U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

II. THE CRAB RESOURCES

1. THE KING CRAB FISHERY

INTRODUCTION

The name "king crab" applies to five species that belong to the genus Paralithodes. Two of these, P. rathbuni and P. californiensis, are not exploited commercially. Therefore, the name usually applies to P. camtschatica, P. brevipes and P. platypus. In Alaskan waters, P. camtschatica is the most abundant species and forms the basis of the commercial fishery. The term "king crab" will refer to P. camtschatica for this discussion.

The king crab resource is the most important exploitable invertebrate fishery in Alaskan waters. From 1965 to 1969, the annual mean value of king crab to fishermen exceeded $15 million. The wholesale market value of king crab exceeded $35 million.(4) The 1973 value to Alaska fishermen exceeded $44 million, of which more than $16 million were received by Gulf of Alaska fishermen.

DISTRIBUTION

P. camtschatica is abundant on both sides of the North Pacific Ocean. On the western coast of North America, the northern limit for the species appears to be Norton Sound (65°N latitude) in the northeastern Bering Sea. King crabs are also abundant in the Gulf of Alaska where major fisheries for them exist at Cook Inlet, Kodiak Island and the south Alaska Peninsula. Moderate numbers of king crab are found in

Prince Williams Sound and southeastern Alaska. The southern limit of this species in the northeastern Pacific appears to be Vancouver Island, British Columbia.(4)

King crabs inhabit a great vertical depth range and occur at depths well beyond the 100-fathom contour.(5) They have been found in depths to 1,200 feet, although the commercial fishery is generally confined to depths less than 600 feet. The greatest abundance of king crab, based on total catches and average catch per hour of NMFS exploratory drags for this species from 1950 to 1971 lie in depth zones ranging from 30-89 fathoms (Figure II-1).(5) Total catches of king crabs were highest in the Kodiak-Shelikof region (Table II-1), where they were frequently taken in most exploratory drags for all depth zones. However, catch rates were lower in this region due to higher single catches in the Cook Inlet area. The highest single catch of king crab (3,000 lbs.) was taken northwest of Ushagat Island in the lower Cook Inlet region. The average catch per hour of successful trawling for king crabs for all regions is illustrated in Figure II-2. It is estimated that a standing stock of approximately 500 million pounds of king crabs exist in the Gulf of Alaska.(5) Distribution of king crabs taken in NMFS exploratory trawls are shown in Figure II-3.

Females and smaller males appear to be most abundant in intermediate depths. Juveniles are most abundant in inshore waters and in relatively shallow waters, although they have been found to depths of 58 fathoms.(4)

King crabs were taken throughout the Gulf from 1961 to 1963 in IPHC exploratory trawl surveys. The Kenai and Yakutat areas apparently support only small populations.

However, catch rates at Kodiak and, particularly, the Peninsula area, indicate high levels of abundance in shallow waters during the winter, followed by shifts into deeper waters in the spring and rather uniform densities at 50-199 fathoms during the summer. Return to shallower waters may begin during the fall as highest catch rates during this period were in 50-99 fathom waters.

Three major locations of high king crab abundance within the Kodiak-Peninsula areas were south of Unimak Island, south and west of the southwest end of Kodiak extending east to waters within Two Headed Gully, and along the east and south side of Afognak Island. IPHC catches were consistently highest off the southwest tip of Kodiak where one or more hauls exceeding 5,000 pounds per hour were made during all seasons except fall.(6)

The favorite bottom habitat of king crabs appears to be muddy or sandy. King crabs are stenohaline and are adapted to cold waters. It has been reported that, in Asiatic waters, commercial concentrations of king crabs are not found where bottom temperatures exceed 12°C.(4)

AVERAGE CATCH OF KING CRABS PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

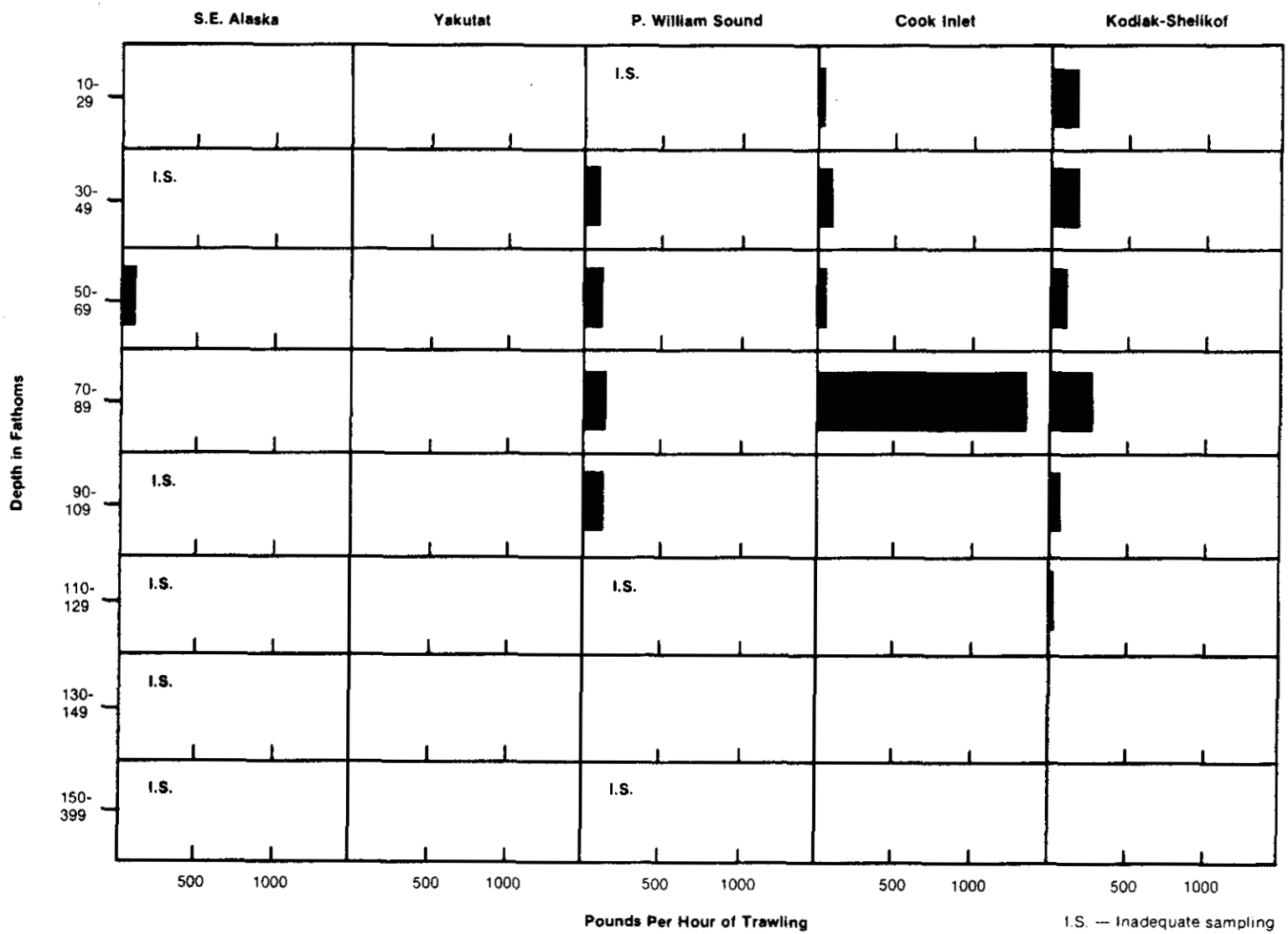


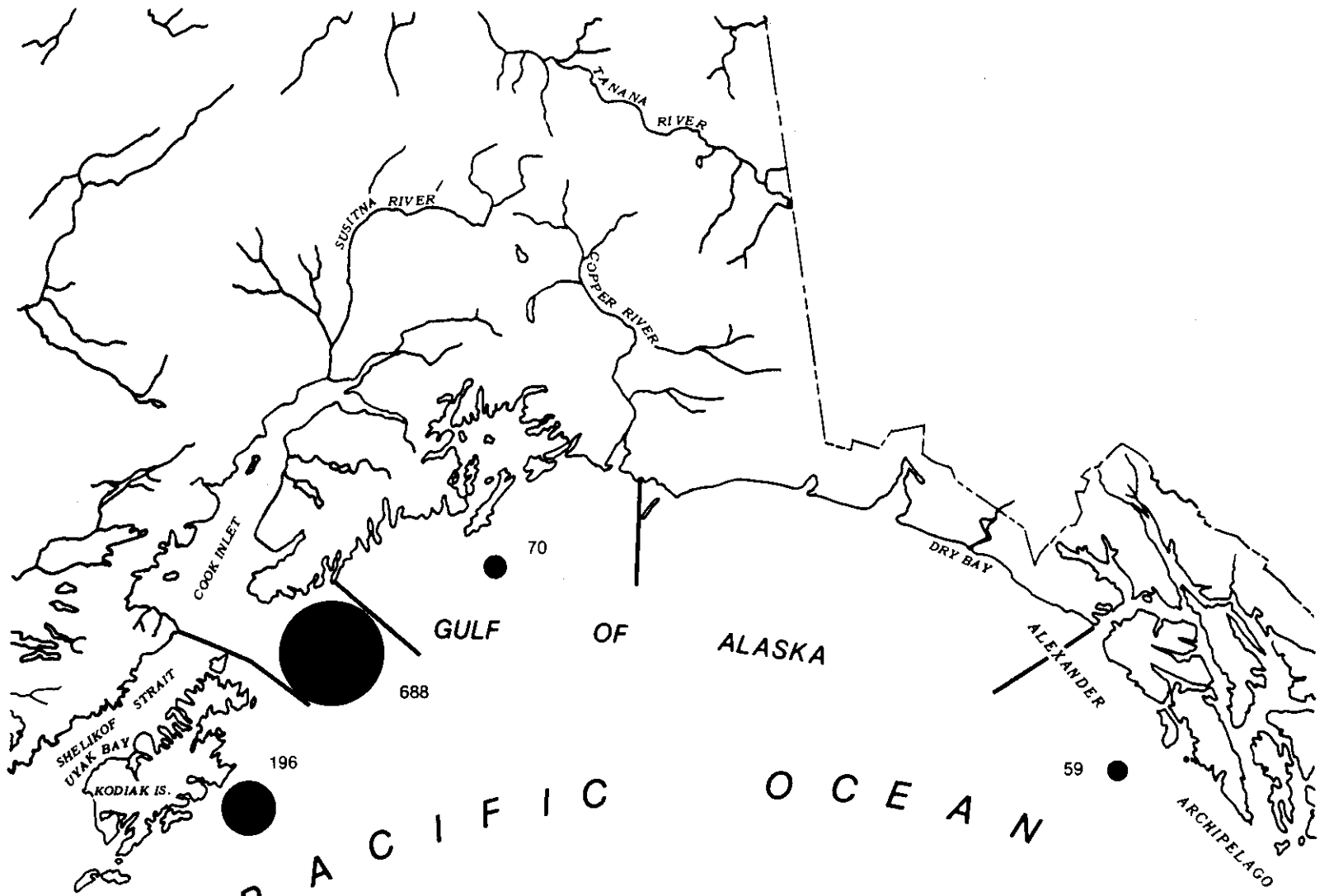
Figure II-1

POUNDS OF KING CRABS CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

DEPTH FM.	S. E. ALASKA			YAKUTAT			P. W. SOUND			COOK INLET			KODIAK-SHELIKOF		
	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR
10-29	-		-	-		-	21	0.9	I.S.[1/]	47	1.5	31	1,193*	5.4	221
30-49	162	1.0	I.S.	-		-	156	4.4	35	330	2.8	118	5,545*	24.5	226
50-69	67	2.1	32	-		-	456	8.2	56	85	1.5	57	2,252*	18.0	125
70-89	-		-	-		-	901	9.1	99	7,176	5.3	1,354	7,817	32.8	238
90-109	10	.4	I.S.	-		-	515	6.8	76	-	-	-	556	6.0	93
110-129	25	.5	I.S.	-		-	12	0.5	I.S.	-		-	160	2.7	59
130-149	12	.5	I.S.	-		-	-	-	-	-		-	-	-	-
150-399	51	1.0	I.S.	-		-	108	1.0	I.S.	-		-	-	-	-
TOTAL	327	5.5		-			2,169	30.9		7,638	11.1		17,523*	89.4	
Avg. catch/hr. for all depths			59			-			70			688			196

1/Inadequate sampling
*Includes exploratory drag data for the period 5-31-69 to 7-25-71.

Table II-1



Average catch in pounds per hour of trawling by regions for king crab based on drags producing 10 pounds or more.

Figure II-2


FIGURE II-3
SHELL OIL COMPANY
GULF OF ALASKA
FISHERY RESOURCES
PLOTTED FISHERIES DISTRIBUTION AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING DRAGS", N. J. WOLOTIRA, S. A. ASTRAKHANTSEFF, W. G. PARKS AND C. R. HITE, N.M.F.S. EXPLORATORY FISHING AND GEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1950-1971.
PREPARED BY ZERAIDE D. MATUNDO
DATE:
BY:
KING CRABS
TRACE TO 3000 LBS./DRAG
BRISTOL BAY
SHELIKOF STRAIT
ALBATROSS
DIXON ENTRANCE

NATURAL HISTORY NOTES

Predators

Sculpins, cod and halibut have been reported to prey on juvenile king crabs. Also, halibut prey on king crabs when they are in a soft-shelled condition. There must be other sources of predation on juvenile king crabs, but it appears that once king crabs attain sexual maturity they are relatively immune to predation except during the molting process.

Diseases and Parasites

P. camtschatica and P. platypus from the eastern North Pacific are occasionally affected by "rust disease" which seems to result from action of chitin-destroying bacteria of the exoskeleton. However, this disease appears to be relatively rare.

It is also reported that P. platypus from Alaskan waters are occasionally invaded by rhizocephalans, probably a species of Peltogaster.

Egg cases and adults of the leech, Notostomobdella cyclostoma are common on Alaskan king crabs, particularly during the summer.

However, in summary, it appears that adult king crabs are not affected significantly by diseases or parasites, nor that they are susceptible to predation except in a soft-shelled condition.(4)

Food

The king crab is omnivorous during both its juvenile and adult stages of life. In a study of the food items found in the stomachs of king crabs in the Bering Sea, the following occurred (in descending order of frequency): Mollusca (clams, etc.); Polychaeta (marine worms); Algae (marine plants); other Crustacea, and Coelenterates (jellyfish); other food organisms found less frequently were foraminiferans, nematode worms, tunicates, echiuroids and fish.(4)

Natural Mortality Rate

There are no published estimates of the natural mortality rate for king crabs found in Alaska waters, a lack of knowledge which is one of the more serious problems facing management. However, the instantaneous natural mortality rate for males between the sizes of 100 to 160 mm carapace length may be quite low. If this is the case, it would appear that a size limit of about 7.5 inches in carapace width would be appropriate because it should increase the yield to fishermen as well as increase the number of times that a male could mate before he was captured. Presumably, recruitment to the stocks would improve if males could mate more often than they do under the present size limit.(4)

FISHING GEAR

Since 1960, American fishermen have been limited to pots to capture king crabs. Initially, these pots were modified Dungeness crab pots, but by 1960, round pots approximately six feet in diameter were used extensively. When fishery moved offshore, the use of 7x7x2 1/2 and even larger square pots became standard, especially with the bigger vessels. It should be noted here that the larger pots increased the efficiency of the larger vessels relatively more than that of the smaller boats because many of the smaller vessels could not handle the larger pots.(5)

GENERAL TRENDS IN CATCH STATISTICS

Total king crab landings for the Gulf of Alaska (Southeast and Central) are shown in Table II-2. The annual catches of king crab by fishing grounds in the Gulf of Alaska are shown in Table II-3. These data show that major fisheries are located at Kodiak Island, south Peninsula and Cook Inlet. Minor fisheries exist in southeastern Alaska, in the Copper-Bering River areas, in Prince William Sound and in the Chignik area.

Annual catches have declined markedly in the Kodiak Island and south Peninsula fisheries; whereas landings have declined less severely at Cook Inlet. In fact, landings at Cook Inlet have remained relatively constant since 1965.

A summary of all crab landings in the Gulf of Alaska are provided in Table II-17 and Figures II-12 and II-13.

The more important areas in which king crabs are taken are shown in Figure II-4.

Table II-2

KING CRAB HARVEST IN ALASKA (SOUTHEAST AND CENTRAL ALASKA ONLY) 1951-1973

Thousands of Pounds & Thousands of Dollars

	SOUTHEAST ALASKA		CENTRAL ALASKA		TOTAL	
Year	Pounds	Value	Pounds	Value	Pounds	Value
1951	-	-	202	36	202	36
1952	-	-	780	109	780	109
1953	-	-	2,614	288	2,614	288
1954	-	-	6,357	604	6,357	604
1955	-	-	5,951	565	5,951	565
1956	-	-	6,900	655	6,900	655
1957	-	-	12,488	999	12,488	999
1958	-	-	11,212	897	11,212	897
1959	-	-	18,839	1,478	18,839	1,478
1960	3	1	27,879	2,230	27,882	2,231
1961	430	43	38,855	3,499	39,285	3,542
1962	1,290	129	44,653	4,465	45,943	4,594
1963	1,112	111	50,787	5,080	51,899	5,191
1964	821	82	51,639	5,021	52,460	5,103
1965	579	58	94,506	9,375	95,085	9,433
1966	106	12	117,305	11,731	117,411	11,743
1967	599	84	83,011	9,593	83,610	9,677
1968	2,200	792	37,559	10,517	39,759	11,309
1969	1,895	508	20,275	5,677	22,170	6,185
1970	560	156	19,559	5,400	20,119	5,556
1971	571	198	20,220	5,902	20,791	6,100
1972	952	385	24,722	8,826	25,674	9,211
1973	874	649	24,611	15,865	25,485	16,514

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

Table II-3.Annual Landings of King Crab in fishing areas of the Gulf of Alaska in thousands of pounds (live weight).

Year	Southeastern Alaska	Copper-Bering Rivers & Prince William Sound	Cook Inlet	Chignik	Fishing Season or year	Kodiak	South-Alaska Peninsula
1951			6.6		1951-52	335.3	
1952			2.9		52-53	579.7	
1953			1,359.9		53-54	2,531.1	
1954			1,275.9		54-55	2,491.5	
1955			1,915.8		55-56	3,717.1	
1956			2,129.0		56-57	7,016.0	
1957			620.9		57-58	5,070.6	
1958			753.0		58-59	7,137.5	7,242.9
1959			2,191.4		59-60	14,348.1	6,965.8
1960	3.4		4,220.3		1960	17,536.8	5,652.3
1961	429.6		4,309.6		1961	29,283.1	4,786.9
1962	1,289.6		6,793.1		1962	34,394.9	3,356.2
1963	1,112.2		8,382.7		1963	43,458.1	7,993.0
1964	820.5		6,967.7		1964	36,505.6	15,071.5
1965	573.3	5.5	2,819.7	769.9	1965	76,837.9	14,407.0
1966	105.8	11.0	3,897.6	561.3	1966	90,726.2	22,519.9
1967	599.0	41.8	3,117.5	247.7	1967	62,864.4	17,180.0
1968	2,189.9	199.6	4,008.6	341.7	1968	22,117.6	10,940.0
1969	1,895.3	48.1	2,852.5	310.1	1969	12,724.1	4,335.3
1970	571.8	94.3	3,888.3	22.8	1970	11,807.3	3,512.2
1971	571.1	144.2	4,157.6	13.8	1971	11,820.0	4,211.8
1972	952.6	296.1	4,607.9	133.3	1972	15,479.9	4,204.9
1973	874.1	207.9	4,349.2	375.8	1973	14,397.3	4,280.7

Ref: (3,4)

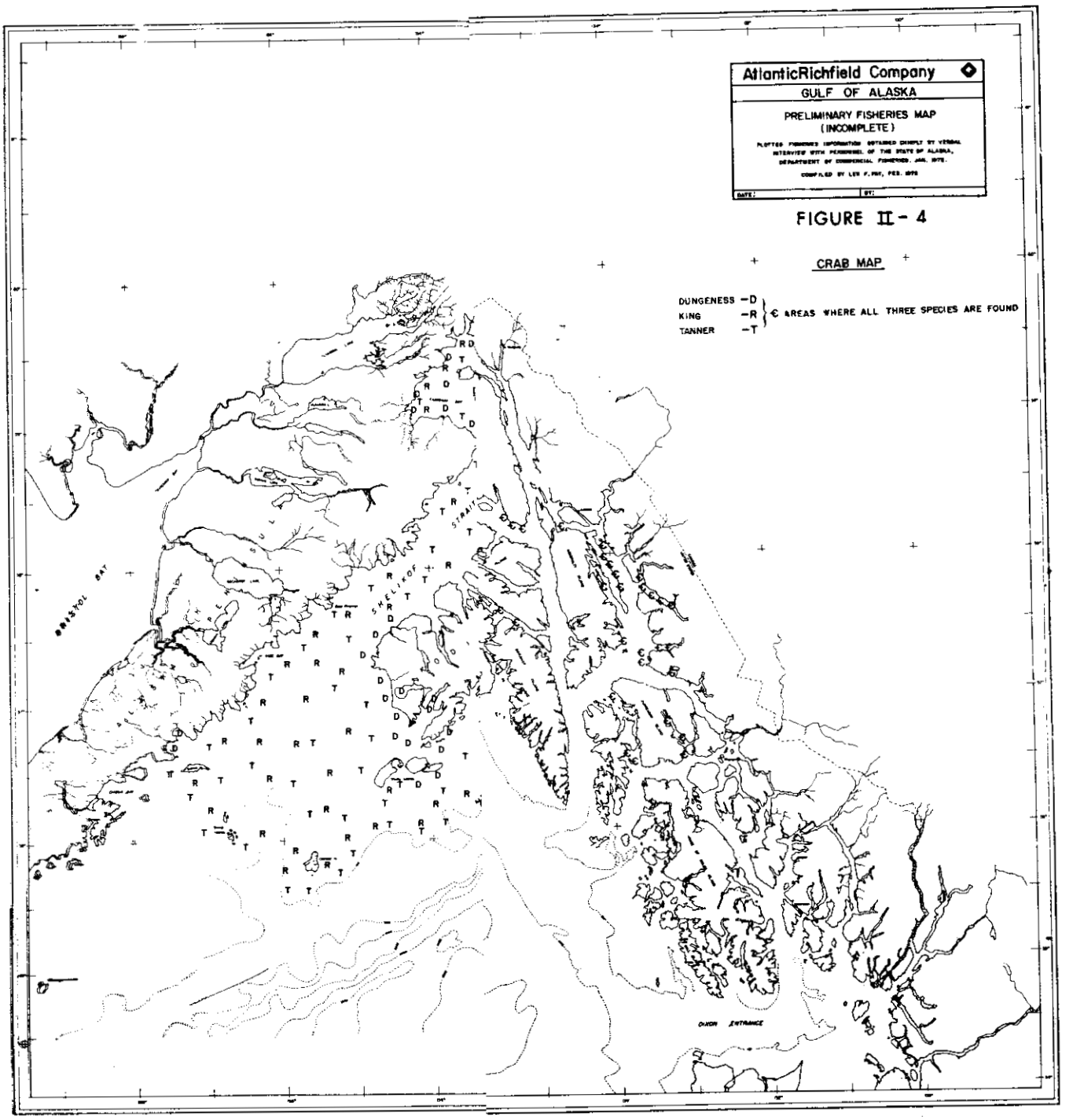

AtlanticRichfield Company
GULF OF ALASKA
PRELIMINARY FISHERIES MAP
(INCOMPLETE)
PLOTTED FISHERIES INFORMATION OBTAINED SOLELY BY VERBAL INTERVIEW WITH PERSONNEL OF THE STATE OF ALASKA, DEPARTMENT OF COMMERCIAL FISHERIES. JAN. 1975.
COMPILED BY LEE F. PAY, FEB. 1975
DATE:
BY:
CRAB MAP
DUNGENESS -D
KING -R
TANNER -T
AREAS WHERE ALL THREE SPECIES ARE FOUND
BRISTOL BAY
SHELIKOF
STRAIT
UNION ENTRANCE

FIGURE II - 4

The average weight of crabs in the commercial catch of the Kodiak fishery has declined from eleven pounds in 1961 to six pounds in 1968. Similar change has occurred in all fisheries in Alaska. The fisheries are now almost entirely dependent on crabs which are recruited into the fishery each year.

In summary, significant declines in annual catch, catch per unit effort (pot) and mean weight of crabs in commercial catch have occurred in all major fisheries in the Gulf of Alaska.(4)

Cook Inlet Fishery

Peak landings from Cook Inlet occurred in the years 1962 through 1964 and can be attributed directly to the expansion of the fishery into previously unexploited areas. Since 1965, both the number of trips and the annual catch has been about one half those of the peak years. In addition, the unadjusted catch per vessel trip has remained reasonably stable (Table II-4).

Cook Inlet began as a winter fishery and through the years has developed into both a winter and summer fishery (Table II-5). Production increased greatly during the summers of 1962 through 1964, a period of maximum production for this area. These data suggest that the offshore movement of the fleet has been to areas which previously had been lightly fished. Furthermore, the lower mean weight of crabs in the commercial catch during the summer months indicates that smaller males may congregate in nearshore waters of moderate depths throughout

the year. In addition, the larger size of crabs in winter catches suggests that larger males may congregate and move either inshore or to shallower areas of the offshore grounds in order to mate. This may make them more vulnerable to fishing.

Another possible explanation for the larger size of crabs taken in the winter is that smaller crabs molt more frequently than larger ones. Since molting crabs are most likely less vulnerable to capture than non-molters, they are less likely to be found in the commercial catch during the molting period. Conversely, the non-molters may be represented in the catch proportionately higher during this period than in the summer or non-molting season.

In summary, the Cook Inlet fishery, which has been conducted from relatively modest sized vessels, has changed from a winter to a combined winter and summer fishery. Peak landings occurred during the years of 1962-1964 and were evidently the result of exploitation of new fishing grounds, not unusually good recruitment. Since 1965, the fishery has been reasonably stable.(4)

Table II-4 Unadjusted Mean Catch per Vessel Trip by Calendar Quarter Years at Cook Inlet for 1960-1968.

Year	Quarter	No. of Trips	Mean Catch (pounds, live weight) per Trip
1960	1	968	1,870
	2	801	1,714
	3	526	1,857
	4	77	791
		2,372	
1961	1	1,096	960
	2	1,119	1,798
	3	513	2,252
	4	58	1,543
		2,786	
1962	1	884	1,442
	2	654	4,450
	3	435	4,856
	4	223	2,073
		2,196	
1963	1	476	3,717
	2	555	5,714
	3	666	4,799
	4	211	1,167
		1,908	
1964	1	341	2,695
	2	400	4,873
	3	667	5,632
	4	134	2,562
		1,542	
1965	1	205	3,909
	2	238	3,555
	3	400	2,783
	4	16	1,734
		859	
1966	1	208	3,048
	2	228	7,371
	3	302	4,754
	4	64	2,303
		802	
1967	1	257	1,875
	2	70	8,267
	3	445	4,401
	4	39	2,317
		811	
1968	1	300	4,392
	2	35	10,237
	3	385	4,685
	4	117	4,235
		837	

Table II-5 Monthly catch of King Crabs in thousands of pounds at Cook Inlet 1960-1968.

Month	1960	1961	1962	1963	1964	1965	1966	1967	1968
Jan.	336.9	237.3	185.6	207.6	143.8	123.2	60.2	20.5	38.1
Feb.	997.6	544.2	424.5	935.6	226.4	52.0	318.0	142.8	345.9
March	475.2	271.0	664.5	626.1	548.7	626.0	255.7	318.6	933.5
April	425.8	270.3	1,000.9	452.0	751.8	372.3	580.4	506.4	358.3
May	648.5	608.4	579.3	866.4	234.5	220.6	514.1	72.3	
June	298.8	1,113.7	1,362.8	1,852.8	962.9	253.1	586.0		
July	545.9	794.4	919.4	1,854.8	2,262.1	509.1	704.7	922.4	
Aug.	420.1	285.8	1,002.9	779.2	1,065.6	526.2	476.0	788.4	1,163.8
Sept.	10.6	74.9	170.1	562.2	428.6	77.9	255.0	247.8	640.0
Oct.	3.9	37.4	182.2	129.1	258.1	.7	20.4	69.2	326.0
Nov.	0.7	20.0	43.8	28.1	28.6	9.1	56.0	11.8	110.0
Dec.	56.4	29.0	23.7	88.9	56.7	17.9	71.0	9.4	59.6
Total	4,220.4	4,306.4	6,579.7	8,382.8	6,967.8	2,788.0	3,897.5	3,109.6	3,975.2

South Alaska Peninsula Fishery

In the late 1950's, catches in the south Alaska Peninsula fishery were approximately 7 million pounds annually. Table 5 shows that the annual landings declined from 1960 until 1962. In 1963, the catch increased sharply, and this trend persisted until 1966. Since that time, annual landings have decreased to about twenty percent of that of the peak year.(4)

Table II-6 shows that the number of trips decreased from 1960 to 1962, which accounts partially for the declining catches. In general, the catch per trip as well as the number of trips increased in the period, 1963 through 1967. This suggests that only part of the increase in catch during this period was due to increased fishing effort. Of course, some of the increase in catch per trip, possibly a major part of it, must be attributed to larger, more efficient vessels. An increase in the abundance of king crabs during this time may also have contributed to the increase in catch per trip. This could occur either (1) an increase in recruitment, or (2) the exploitation of new grounds.(4)

Table II-7 shows the monthly catch in pounds for the south Alaska Peninsula fishery for the period, 1960-1968. It is interesting to note that the summer and fall fisheries were dominant during 1962-1966. In fact, it is obvious that the bulk of the increased catches during this time occurred during these months.

Table II-6. Unadjusted Mean Catch per Vessel Trip by Calendar Quarter Years at S. Alaska Peninsula 1960-1968.

Year	Quarter	No. of Trips	Mean Catch (pounds, live weigh per Trip
1960	1	726	4,073
	2	102	2,262
	3	203	5,292
	4	464	2,997
		1,495	
1961	1	323	3,770
	2	58	4,174
	3	305	5,380
	4	315	5,353
		1,001	
1962	1	198	3,220
	2	37	3,966
	3	186	4,637
	4	307	5,568
		728	
1963	1	150	5,753
	2	34	4,302
	3	422	8,080
	4	526	6,795
		1,132	
1964	1	246	6,650
	2	53	7,082
	3	427	14,544
	4	626	10,942
		1,352	
1965	1	291	11,738
	2	91	7,688
	3	411	11,344
		793	
1966	1	398	17,214
	2	102	13,999
	3	416	15,243
	4	375	21,759
		1,291	
1967	1	342	26,914
	2	54	15,010
	3	385	10,363
	4	254	11,971
		1,035	
1968	1	279	16,648
	2	68	9,299
	3	298	12,839
	4	287	7,505
		932	

Table II-7 Monthly catch in S. Alaska Peninsula King Crab Fishery for the years 1960-1968 in thousands of pounds.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Jan.	684.2	286.9	258.0	187.4	687.9	1,188.7	1,426.9	2,527.6	922.9
Feb.	1,257.5	627.2	145.8	334.6	460.8	1,013.8	2,247.8	2,933.7	1,541.7
March	1,015.0	303.5	233.7	341.0	487.3	1,213.2	3,176.7	3,743.1	2,180.3
April	230.3	59.3	111.7	80.0	63.6	449.3	1,206.4	629.3	308.9
May	0.5	111.6	35.0	40.5	53.6	104.7	129.5	80.1	120.4
June		71.2		25.7	258.1	145.6	92.0	101.2	203.0
July		95.9	41.5	144.8	1,202.4	939.0	645.4	1,153.6	611.8
Aug.	146.0	362.0	166.7	780.0	1,906.7	2,696.0	2,367.4	1,260.0	1,050.4
Sept.	928.4	1,183.0	654.2	2,485.0	3,101.4	2,641.9	3,328.1	1,576.2	2,163.8
Oct.	698.7	1,026.0	845.6	1,303.7	3,585.7	1,995.8	3,244.8	1,696.6	812.1
Nov.	270.8	335.4	404.7	1,407.1	1,729.2	1,501.6	2,359.1	766.0	750.4
Dec.	421.0	324.9	459.2	863.2	1,534.9	1,210.4	2,555.8	578.1	591.5
TOTAL	5,652.4	4,786.9	3,356.1	7,993.0	15,071.6	15,100.0	22,779.9	17,045.5	11,257.2

At least two interpretations of these data are reasonable. The first is that unusually good recruitment occurred in 1963 and possibly, 1964. After that time, the fishery exploited those year classes which sustained the fishery until 1969.

The second hypothesis is that the fishery selected larger crabs during the years 1960-1962, which was a period of declining effort. In 1963, because of increased effort, fishermen exploited smaller crabs in the traditional fishing grounds. Fishing effort continued at a high level during the period 1964 through 1968, which compelled fishermen to exploit new grounds. When all grounds had been fully exploited by the late 1960's, landings decreased drastically.

In summary, the south Alaska Peninsula fishery has changed from a small-boat, winter fishery to a large-vessel fishery which is prosecuted in both the summer and winter months. The large increases in catch during the mid-1960's occurred during the summer months, which is indicative of the exploitation of new grounds. However, it is also possible that good recruitment to the fishery during 1963 and 1964 helped to increase landings.(4)

Kodiak Fishery

A king crab fishery has been well established in the northwestern Gulf (largely in the Kodiak area) for many years. Table II-8 gives the production of king crabs by district and fishing season from 1960-1961 through 1970-1971.(4) In all cases, production increased sharply when fishermen moved offshore. Again, once the offshore grounds were fully exploited, production dropped sharply, although this occurred at different times in the various districts due to the movement of fishing effort between areas. The southeast Kodiak district, which has been the most productive fishing ground, has suffered the most pronounced drop.

Catch statistics also demonstrate that, through the years, Kodiak fishing districts have alternated in their importance to the annual landings. This has been due to the shifting of large vessels between districts, especially between the southeast and southwest ones.(4)

It is important to understand the selective nature of the fishery at Kodiak. In general, fishermen exploited the larger crabs first. When these became depleted, they were compelled to either (1) exploit smaller crabs in the traditional fishing grounds (this occurred in the southwest fishery in the late 1950's and early 1960's) or (2) turn to the nearshore and offshore grounds in order to exploit the larger crabs there. After the larger crabs had been taken in all fishing grounds, fishermen took all legal crabs.(4)

Table II-8 Kodiak King Crab Production in Pounds by District and Fishing Year, 1960-1961 through 1970-1971

Fishing Year	Northeast	Southeast	Southwest	Shelikof	Total
1960-1961	2.2	7.2	7.5*	2.2	19.1
1961-1962	4.7	8.8	9.7*	7.0	30.2
1962-1963	9.2	11.9*	10.8	3.9	35.8
1963-1964	17.3	12.3*	5.8	4.1	39.5
1964-1965	13.5	21.2*	3.5	2.8	41.0
1965-1966	23.3	58.6*	12.1	1.8	95.8
1966-1967	14.9	39.2*	15.6	3.4	73.1
1967-1968	9.9	8.4	21.1*	4.4	43.8
1968-1969	5.1	4.2	6.7*	2.6	18.6
1969-1970	3.2*	3.2*	3.2*	2.6	12.2
1970-1971	3.2	4.0*	2.2	2.3	11.7
	106.5	179.0	98.2	37.1	420.8

*District which contributed most to annual Kodiak landings.

Another factor which affected production at Kodiak was the earthquake damage sustained in March of 1964.(2) This event severely damaged production facilities as well as a substantial part of the fishing fleet.

Because of the damage to processing facilities, many vessels moved to the Adak area in 1964. However, by April of 1965, all of the earthquake damage had been repaired, and four new crab processing plants had been built.(2) This greatly increased the processing capacity of the industry which, together with the increased level of demand for king crab, enabled the industry to harvest all it could catch. That this happened is readily apparent from the catch statistics for 1965-1967.(4)

Shelikof Fishery

Table II-9 shows the catches by fishing year as well as the mean weight of commercial crabs by month for the Shelikof district. Peak catches occurred during the fishing seasons, 1961-1962 and 1967-1968. The annual catches between those seasons, especially for the 1964-1965 and 1965-1966 seasons, were apparently due to decreased effort and not to a lack of crabs.(4) Table II-10 shows that the increase in catches experienced during the years 1961 to 1964, was largely due to the development of the summer fishery.

The peak catch of the 1961-1962 season was due to the increased effort, not to an increase in catch per trip. In fact, the unadjusted catches per trip in that season were much less than those of the former season. This suggests that the higher catch per trip recorded in the 1960-1961 fishing season induced fishermen to enter the Shelikof district in the 1961-1962 season.(4)

However, the Shelikof fishery has been of relatively minor importance to the total Kodiak fishery except during the 1961-1962 and the 1967-1968 seasons.

Table II-9 Monthly Mean Weight of Commercial Crabs Taken in the Shelikof District for the Fishing Years 1959-1960 through 1968-1969.

Quarter	59-60	60-61	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
3		8.68	8.74	9.09	7.44	8.46	8.75	8.23	8.10	
		7.09	8.56	8.59	7.41	8.31	8.35	8.58	8.18	7.52
			8.14	8.71	7.85	8.32	8.29	6.50	7.81	7.33
4		8.68	8.06	8.88	8.33	8.47	7.82	8.63	8.16	7.64
		8.19	8.66	8.70	7.74	8.43	8.10	9.62	9.28	8.35
		8.74	8.90	9.03	7.50	8.87	8.45	9.15	10.11	8.63
1	10.49	9.84	10.32	10.47	8.60	8.86	8.75	9.04	10.45	
	11.21	10.64	10.83	10.83	9.99	9.10	9.37	9.88	10.59	
	10.70	10.57	10.77	10.30	9.84	8.65	8.63	9.65	10.25	
2		10.08	10.32	8.70	10.00	7.75	8.26	9.55	10.71	
	9.94	10.57	9.72	8.57	8.88	8.67		9.33		
	8.71	9.38	9.55	7.76	8.54	9.13	9.02		7.79	
Catch in Millions of Pounds		2.2	7.0	3.9	4.1	2.8	1.8	3.4	4.4	2.6

Table II-10 Monthly Catch of King Crabs in the Shelikof District (Stocks 4-6) in thousands of pounds for 1960-1968.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Jan.	34.7	193.1	345.3	619.8	98.9	80.6	61.7	88.3	465.7
Feb.	12.6	931.3	1,079.7	1,184.0	259.1	160.6	52.7	860.8	405.7
March	569.8	223.7	1,124.6	166.9	186.0	226.2	51.8	762.1	198.0
April		47.9	201.1	20.7	3.0	68.2	36.9	242.9	3.4
May	16.6	321.3	99.8	114.5	162.0	10.4		13.6	
June	68.0	863.8	436.8	693.6	500.6	44.6	70.6	18.8	7.1
July	211.6	1,140.8	350.1	387.8	578.5	155.5	51.4	273.9	
Aug.	5.1	351.8	107.6	701.5	903.4	163.0	191.0	432.9	917.3
Sept.		473.9	110.9	770.1	746.3	361.7	308.2	400.1	664.0
Oct.	28.1	461.7	343.0	349.1	463.5	206.7	339.4	741.8	380.2
Nov.	41.0	323.5	218.4	265.3	330.8	133.1	282.3	683.5	245.5
Dec.	65.2	249.5	292.0	247.0	71.0	78.6	110.0	707.5	199.2
TOTAL	1,052.7	5,582.3	4,709.3	5,520.3	4,303.1	1,689.2	1,556.0	5,226.2	3,486.1

Southwest Fishery

In the mid and late 1950's, fishermen fished large crabs in the inshore waters of the southwest district. This caused a severe drop in catch per landing which prompted fishermen to move offshore. Large concentrations of crabs were found offshore. Because of the less abundant larger crabs in the traditional fishing areas in the southwest district, many fishermen shifted their operations to the southeast district. After the depletion of legal crabs in the southeast district, most of the fleet returned to the southwest fishery which resulted in a temporary increase of catches. However, the abundance of commercial crabs was soon reduced and catches dropped sharply once the offshore grounds had been heavily exploited.(4)

Southeast Fishery

The southeast fishing district, unlike the others, contributed relatively little to king crab landings during the 1950's. It did not become fully exploited until large numbers of vessels equipped with live tanks entered the Kodiak fishery. However, since the arrival of the larger vessels, it has been the most productive district at Kodiak. It has also suffered the most severe drop in catch as shown by Table 7.

Peak landings for this district occurred in the 1964-1965 through 1966-1967 seasons. During these years, the district contributed over half of the annual catch at Kodiak.

The level of annual landings has changed drastically in the southeast district during the 1960's. The observed changes could have been primarily the result of the entry of one or more large year classes into the fishery during the mid-1960's.(4)

Northeast Fishery

The northeast district fishery differs significantly from the other major fishing districts in several respects. First, it occupies a large area characterized by deep water and strong currents. Second, the unadjusted catches per vessel trip have always been about one half of those from other major areas as shown in Table II-11. Third, in contrast to the southeast and southwest fisheries, a strong winter fishery has prevailed here as shown by Table II-12. Since there is a lack of more recent data, it is not known if this condition still exists. Finally, until the 1968-1969 fishing season, the mean size of crabs in the commercial catch appeared to remain significantly higher than those found in the other major fishing areas. Again, a lack of recent data prevents knowing if this condition still exists.(4)

Table II-11 Unadjusted Mean Catch Per Vessel Trip by Calendar Quarter Years for Northeast District (Stock 1) for 1960-1968.

Year	Quarter	No. of Trips	Mean Catch (pounds, mean weight) Per Trip
1960	1	36	3,081
	2	1	1,923
	3	45	5,755
	4	144	4,431
1961	1	121	6,002
	2	137	4,848
	3	224	5,880
	4	269	5,158
1962	1	450	3,573
	2	121	2,366
	3	155	6,588
	4	369	6,076
1963	1	646	8,731
	2	215	6,300
	3	542	9,549
	4	570	9,435
1964	1	561	9,113
	2	107	10,765
	3	258	14,820
	4	260	15,074
1965	1	524	15,324
	2	155	6,617
	3	323	15,704
	4	544	15,243
1966	1	743	11,636
	2	144	6,656
	3	330	11,620
	4	588	8,155
1967	1	769	7,238
	2	183	8,329
	3	515	5,092
	4	478	8,139
1968	1	491	5,044
	2	87	6,451
	3	238	6,959
	4	339	5,866

Table II-12 Monthly Catch in Northeast District (Stock 1) for 1960-1968 in thousands of pounds

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Jan.	10.1	227.7	702.7	1,735.5	2,826.3	2,668.8	3,062.5	1,675.8	1,013.4
Feb.	29.5	351.3	436.1	2,998.9	1,964.0	2,663.5	3,416.7	1,525.2	906.0
March	71.3	147.3	469.1	905.9	322.4	2,698.0	2,166.5	2,365.3	557.3
April	1.9	34.5	67.0	102.9	87.7	552.9	871.6	653.4	82.6
May		203.4	115.8	379.1	376.0	186.5	32.4	720.2	236.7
June		426.3	103.5	872.4	688.1	286.2	54.6	150.7	241.9
July	53.1	3.514	170.9	1,501.9	1,195.5	538.8	862.3	1,092.9	23.8
Aug.	155.0	555.6	361.3	1,667.1	910.2	1,919.2	1,492.3	895.8	727.8
Sept.	50.9	446.2	489.0	2,006.5	1,717.9	2,614.4	1,480.1	633.7	904.5
Oct.	60.7	287.1	851.9	2,194.1	1,876.0	2,261.4	922.2	1,208.0	955.2
Nov.	156.2	484.1	555.3	1,632.6	920.9	2,969.4	1,469.6	1,236.3	549.5
Dec.	421.2	616.4	835.0	1,551.4	1,122.5	3,061.4	2,403.3	1,446.2	484.0
TOTAL	1,009.9	4,095.3	5,157.6	17,548.3	14,007.5	22,420.5	18,234.1	13,603.5	6,682.7

2. THE SNOW CRAB FISHERY

INTRODUCTION

Snow crabs (Tanner Crabs) have the potential of becoming one of the important commercial species of the Gulf of Alaska. Members of the genus Chionocetes (snow crabs) are widely distributed in the northern Pacific Ocean. The total snow crab catch in this area by United States, Russian and Japanese fishermen exceeded 24 million crabs in 1969.[7] The success of the snow crab fishery in the eastern Bering Sea, as well as the declining catches of king crab in Alaskan waters, has led to the development of an American fishery for snow crabs in the Gulf of Alaska.[1] In 1973, the value of the fishery to Gulf fishermen exceeded $10.5 million.

DISTRIBUTION OF SNOW CRABS

Snow crabs have a circum-arctic distribution, extending into temperature waters on the east and west coast of North America and Eurasia. Members of this genus are found in shallow waters as well as depths to 1,625 fathoms.

C. bairdi occurs from the littoral zone to depths of 259 fathoms. Its range extends from Puget Sound, Washington to the Aleutian Islands and the southeastern Bering Sea where it has been

reported to be the most common species in the commercial catch. It has been reported that C. bairdi is the only snow crab exploited commercially south or east of the Aleutian Islands.(7)

Like king crab, snow crabs have great vertical depth range. They were most abundant on the outer continental shelf and upper slope at depths between 50 to 149 fathoms from Cook Inlet to west of Kodiak Island (Table II-13 and Figure 4), as determined by Bureau of Commercial Fisheries exploratory trawls from 1950-1971. Highest catch rates were observed in the lower Cook Inlet area at 50-109 fathom interval. They were frequently caught in all regions explored. The average catch per hour of trawling for snow crabs in all regions are shown in Figure 5.(5)

Distribution of snow crabs taken in NMFS exploratory trawls from 1950 to 1971 are shown in Figure 3.

IPHC exploratory trawls in the Gulf from 1961 to 1963(6) revealed that snow crabs were more evenly distributed throughout the Gulf than king crabs; however, their abundance remained much higher in the Kodiak-Peninsula areas as compared with the Kenai-Yakutat areas. The Gulf-wide average catch rate of snow crabs was 199.6 pounds per hour trawled. In the Kodiak-Peninsula areas, highest abundance occurred in shallow waters during the winter (1-99 fathoms), followed by movements into deeper waters in the spring. Snow crabs were distributed over a wide range of depths during the summer, but most of the resource occurred at depths of 50-199 fathoms. Seasonal variations in the depths distribution of snow crabs off Yakutat was somewhat different than in the

northwestern Gulf. While the summer distribution was similar, crab off Yakutat were rather evenly distributed from 1 to 199 fathoms during the winter instead of being highly concentrated in shallow waters.

Locations of heavy densities include the south coast of Unimak Island during the winter, spring, and summer; off the southwest tip of Kodiak during the winter; and south of Ugak Bay during the summer. Catch rates, ranging from 1,000 to greater than 5,000 pounds per hour, were made in localized areas along the Peninsula, other areas around Kodiak, and in waters outside Prince William Sound.(6)

AVERAGE CATCH OF TANNER CRABS PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

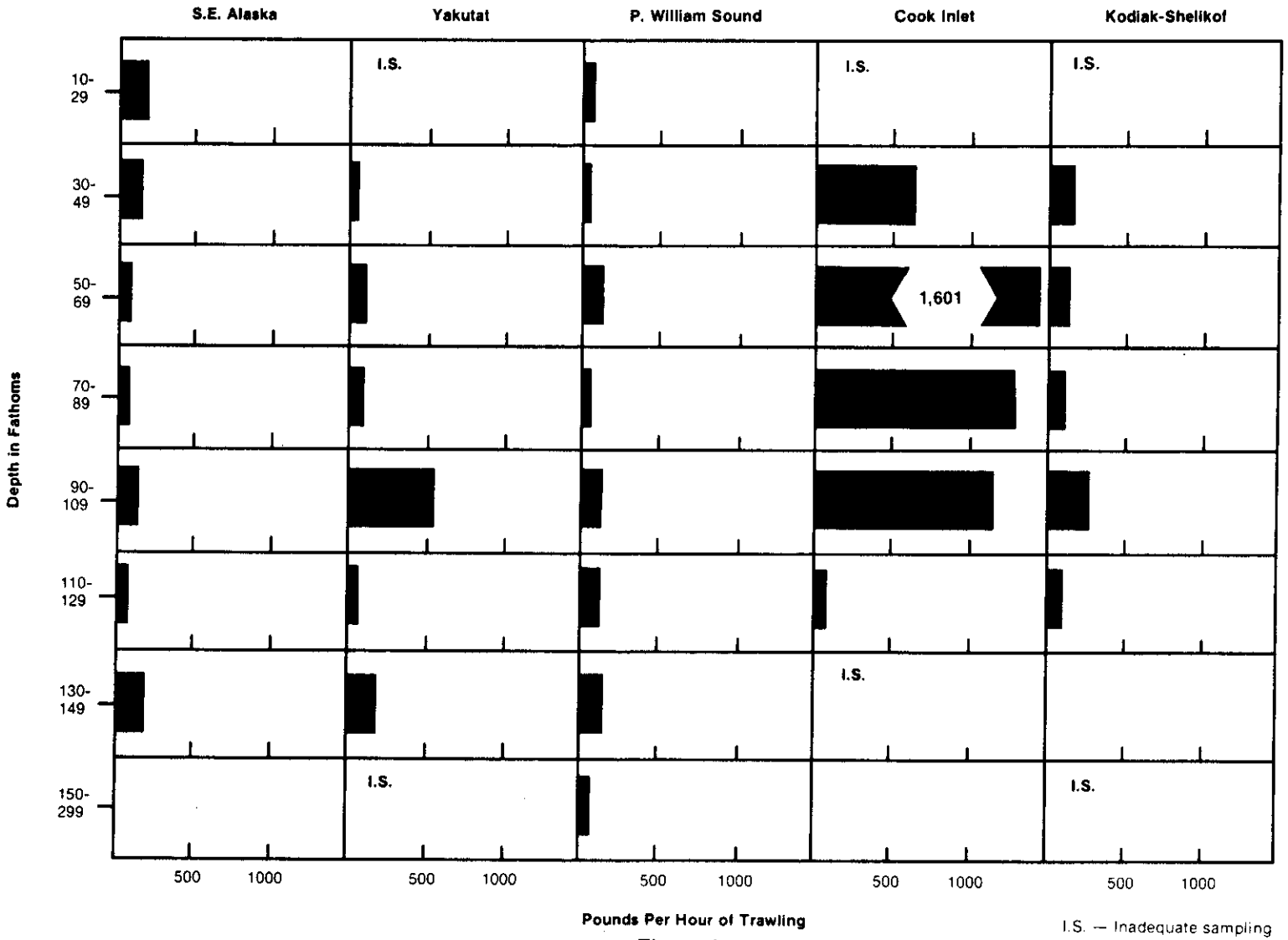


Figure II-5

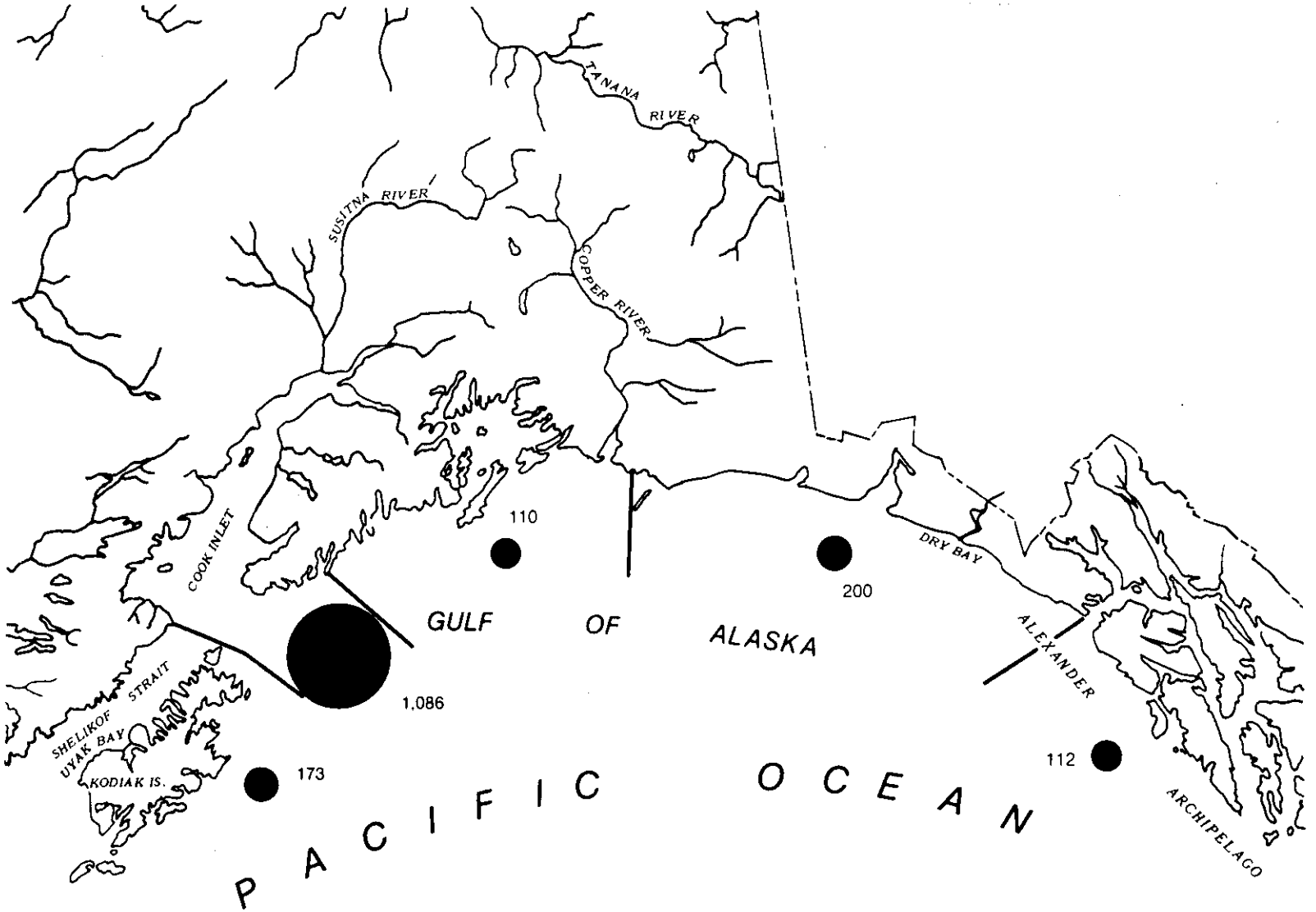
Table II-13

POUNDS OF TANNER CRABS CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

DEPTH FM.	S. E. ALASKA			YAKUTAT			P. W. SOUND			COOK INLET			KODIAK-SHELIKOF,		
	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR
10-29	350	2.0	175	155	1.1	I.S.[1]	229	2.9	79	20	0.5	I.S.	419*	1.7	I.S.
30-49	782	5.2	150	176	4.0	44	363	6.5	56	1,605	2.5	642	3,663*	18.2	201
50-69	491	7.0	70	1,784	14.7	121	5,090	38.4	132	4,804*	3.0	1,601	2,716*	18.7	145
70-89	297	4.5	66	1,371	12.9	106	2,284	34.3	66	17,845	13.8	1,293	2,147	17.3	124
90-109	556	4.0	139	5,940	10.4	571	7,030	54.3	129	3,570	3.1	1,152	3,543	13.4	264
110-129	92	1.5	61	197	4.0	49	2,559	21.2	121	120	2.0	60	977	8.0	122
130-149	360	2.0	180	385	2.0	192	1,257	8.9	141	50	0.9	I.S.	-	-	-
150-299	-	-	-	38	1.0	I.S.	378	7.3	52	-	-	-	25	0.5	I.S.
TOTAL	2,928	26.2		10,046	50.1		19,190	173.8		28,014*	25.8		13,490*	77.8	
Avg. catch/hr. for all depths			112			200			110			1,086			173

[1] Inadequate Sampling

*Includes exploratory drag data for the period 5-31-69 to 7-25-71.



Average catch in pounds per hour of trawling by regions for tanner crab based on drags producing 10 pounds or more.

Figure II-6

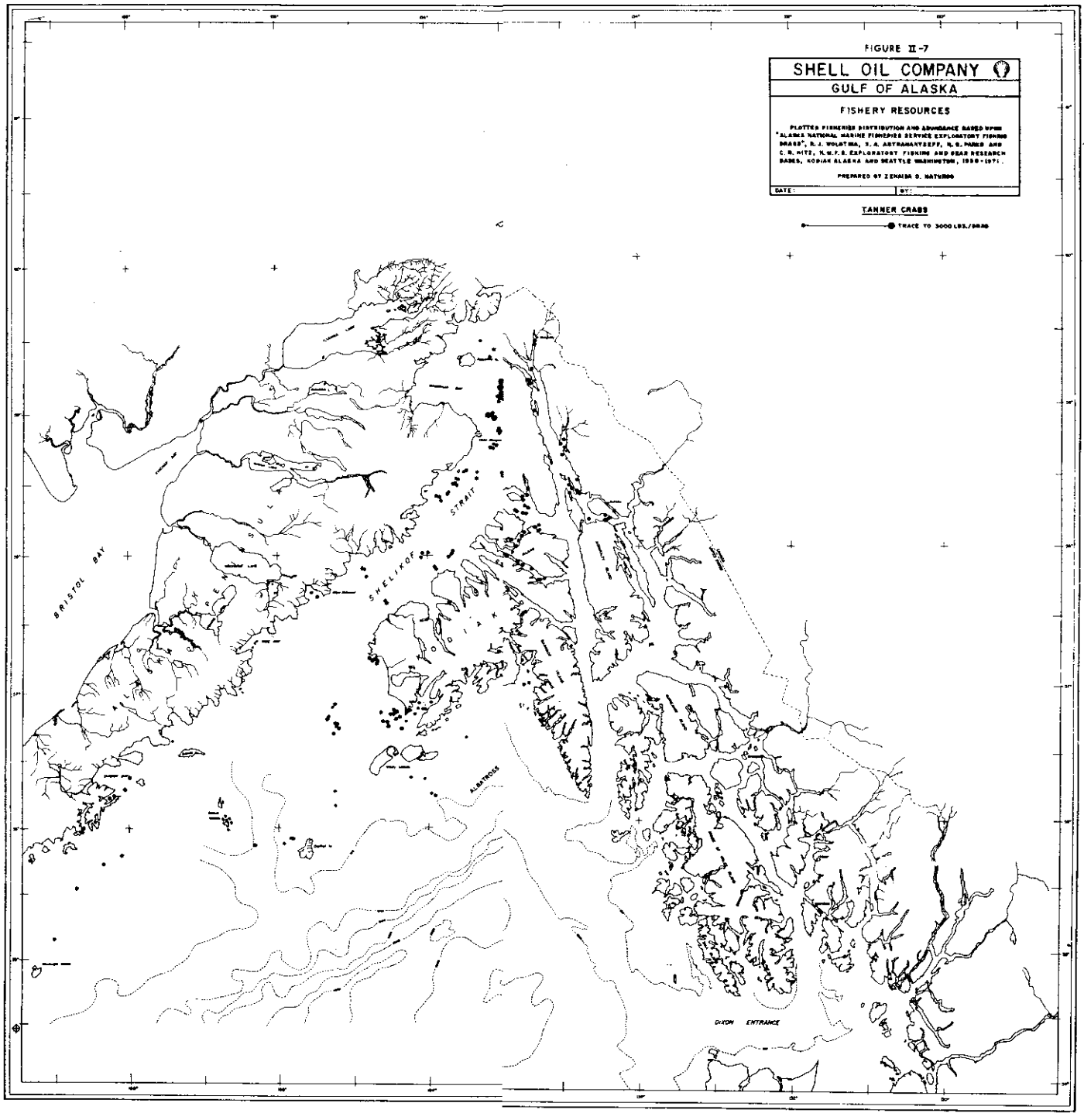


FIGURE II-7
SHELL OIL COMPANY
GULF OF ALASKA
FISHERY RESOURCES
PLOTTED FISHERIES DISTRIBUTION AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING BOATS", R. J. WOLOTIRA, T. A. ARTAMANTSEFF, H. O. PEARCE AND C. R. MITZ, N.M.F.S. EXPLORATORY FISHING AND GEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1956-1971.
PREPARED BY ZENAIDA O. BATUNGO
DATE:
BY:
TANNER CRABS
TRACE TO 3000 LBS./BOAT
BRISTOL BAY
SHELIKOF STRAIT
ALBATROSS
DIXON ENTRANCE

NATURAL HISTORY NOTES

Juveniles

Very little material has been published concerning the habitat and distribution of juvenile snow crabs. However, investigations indicate that young crabs occupy the sea bottom in depths of 300 to 350 meters.(7)

Adults

Adult snow crabs appear to have few predators, although during molting they could be vulnerable to large fish and perhaps other large crustaceans such as the king crab. It has also been suggested that king and snow crabs may compete for either food or space. If this is true, it would appear that the larger size of the king crab would give it a competitive edge over the smaller snow crab. The subject of competition between these two species poses the question of whether the populations of snow crabs could be affected by the abundance of king crabs. In this regard, the depletion of the larger male king crabs by the present intensive fishery might have a favorable effect on the abundance of snow crabs.(7)

Diseases

Snow crabs, as for all organisms, are subject to disease. A black encrustment on the shell labelled "shell syndrome" has been

reported.[7] Apparently, "shell syndrome" does not affect the meat of snow crabs but may cause mortality in individuals which have undergone their terminal molt, because this disease has been observed to disable mouthparts and eyes. Investigations indicated that the incidence of this disease varied considerably and was highest on the east side of Kodiak Island. It has also been suggested that discharging wastes from crab processing plants into Kodiak Harbor may be contributing to the spread of this disease.

Some polyclad Turbellaria are ectoparasitic on crabs. In particular, Coleophora chinonoecetis has been found on the eggs of the snow crab, C. bairdi. Further, the leech, Carcinobdella kanibir, has been found on C. opilio in Asiatic waters.[7]

Food Habits

Stomach contents of Chionocecetes collected in Japanese waters was essentially composed of Echinodermata (especially Ophiuroidea), Crustacea (Decapoda and Amphipoda) and bivalve mollusks, while fish remains, Cephalopoda, Gastropoda, Scaphopoda and Polychaeta were found less frequently. Small planktonic Copoepoda, Cirriped larvae, Foraminifera and Diatomacea were also found, but these were considered as having been ingested incidentally.[7]

Salinity Tolerance of C. opilio

Canadian scientists have demonstrated in the laboratory that C. opilio will die within twenty-four hours if kept in salinities less than 22.5%. At higher salinities, the crabs survived when kept in a temperature range of from 2 to 10°C.(7)

Temperature Tolerances

The fifty percent mortalities of C. opilio, kept at temperature from 12 to 20°C at a salinity of approximately 31-32% are shown here.(7)

TEMPERATURE	TIME TO 50% MORTALITY
20°C	0.07 day
16°C	18.80 days
12-15°C	24 to 29 days

Migrations and Local Movements

Little is known concerning the migrations and local movements of snow crabs. However, tagging studies conducted by Canadian scientists indicated that tagged male crabs travel relatively little with eighty-five percent of the returns recaptured within ten miles of the release point. The most distant recapture in this experiment was a male that traveled twenty-eight miles.

On the basis of a limited tagging experiment in Auke Bay, Alaska, it has been concluded that snow crabs may return to a "home" area to mate and molt each year.(7)

Population Structure

With the exception of published results of trawling surveys in the Gulf of Alaska and the eastern Bering Sea, there are few published data concerning the population structure of snow crabs in these areas. For this reason, all remarks concerning the level of abundance and possible yields of snow crabs must be considered educated guesses only.

There has been less work done on snow crabs in the Gulf of Alaska than in the Bering Sea. Consequently, there is less known about the resource in this area. Specifically, there is little information concerning the sex ratio, size composition, age composition, growth rate, natural mortality rate, fecundity, mating behavior, or stock definition of tanner crabs in this area. In addition, if the demand for snow crabs increases rapidly in the next several years, it is almost certain that the resource will be severely overexploited, which will lead directly to economic hardship for both the harvesting and processing segments of the industry.

In the summer and fall of 1961 and the spring of 1962, a survey of the northeastern Gulf of Alaska revealed that snow crabs were most abundant in depths of 51 to 150 fathoms. The catch rate of snow

crabs was highest in the 101- to 150-fathom interval. Eighty-five percent of the trawl drags west and fifty percent of the catches east of Middleton Island had snow crabs. The largest catch, 2,390 pounds per hour of trawling, occurred northwest of Middleton Island.(7)

HISTORY OF FISHERY

The exploitation of snow crabs has been directly related to the decline in king crab landings. This is illustrated by the fact that most of the snow crabs are landed during the closed season for king crab. In addition, landings have been regulated by the weak demand for snow crab meat. The following factors have contributed to the present market conditions: (1) uneconomical extraction of meat from the shell, (2) relatively low consumer acceptance, (3) competition on the United States market from imported Chionoecetes crab meat, and (4) a black encrustment on crab shells (shell syndrome).

FISHING GEAR

Snow crab gear consists mostly of modified king crab pots. However, some fishermen are using pots designed specifically for snow crabs.

FISHING INFORMATION

Figure II-8 identified locations of major snow crab catches taken from the Alaska continental shelf in 1969 by Japan, Russia, and the United States.(7) Kodiak, Cook Inlet and Prince William Sound are the major United States snow crab fisheries. Table II-14 lists snow crab

landings in Alaska by area from 1967 to 1973, and illustrates that Kodiak is the dominant fishing area at this time. Also see Table II-17 and Figures II-12 and II-13 for all Gulf crab landings.

Investigations have shown that the highest catch per pot came from depths of 100-120 fathoms. At depths less than 100 fathoms, catch per pot varied between fifty and seventy individuals. These data probably show the relative abundance of snow crabs at different depths at this time of year. Of course, the abundance of crabs at different depths may vary seasonally.

At the present time, the only closed season for snow crab occurs for two weeks just prior to the opening of the king crab season. However, most of the landings in the Kodiak fishery are taken from February to May when fishing for other species is either prohibited or at a low level.

The level of fishing effort has been regulated primarily by processors imposing quotas on the number of crabs that they will buy. Similarly, processors have limited purchases to only the largest crabs. Although this method is working well now, the State of Alaska should enact both size and catch limitations in order to protect the resource in the event that the market for snow crab should increase substantially.

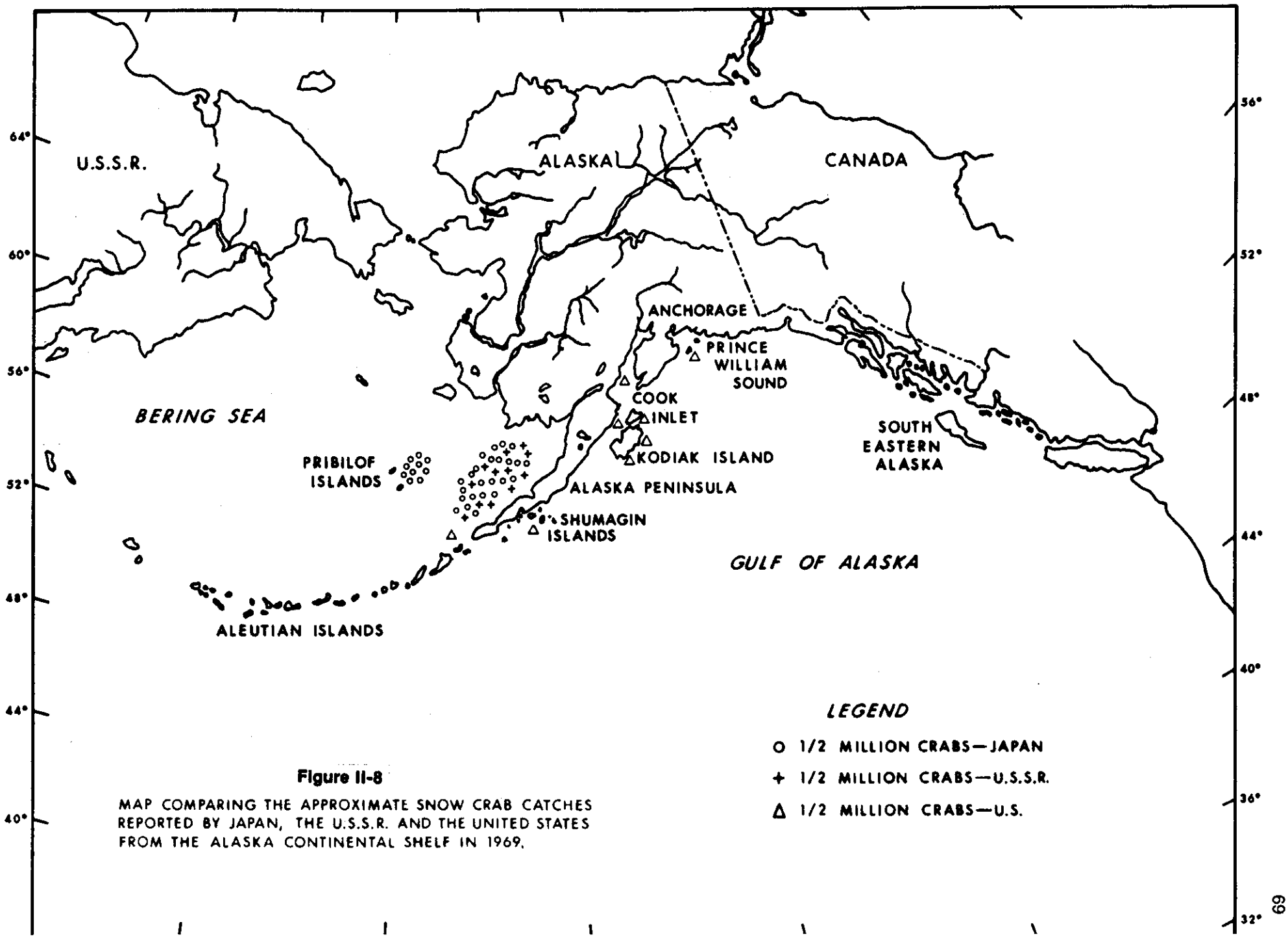


Figure II-8

MAP COMPARING THE APPROXIMATE SNOW CRAB CATCHES REPORTED BY JAPAN, THE U.S.S.R. AND THE UNITED STATES FROM THE ALASKA CONTINENTAL SHELF IN 1969.

Table II-14. Annual Landings of Tanner Crab (Snow Crab) in fishing areas of the Gulf of Alaska in thousands of pounds (live weight).

Year	Southeastern Alaska	Copper-Bering Rivers & Prince William Sound	Cook Inlet	Kodiak	Chignik	South Peninsula	Aleutians East Unalaska	Aleutians West-Adak	Bering Sea
1967	2.7	--	--	111.0	1.6	3.1	--	--	--
1968	109.2	245.1	165.1	2,560.7	21.6	110.6	12.8	--	21.9
1969	267.4	936.5	1,468.1	6,822.7	38.1	606.3	21.0	2.2	1,033.2
1970	583.2	1,292.4	1,328.7	7,708.1	2.8	2,093.6	--	--	1,464.4
1971	251.1	642.3	2,116.8	7,410.8	152.3	2,140.8	--	--	166.0
1972	790.1	8,550.7	4,807.8	11,906.6	26.5	3,938.1	3.9	--	111.7
1973	1,893.0	12,296.8	8,509.1	31,519.9	918.1	5,652.8	59.0	168.5	301.8

Ref: (3)

PUBLISHED ESTIMATES OF ABUNDANCE AND POTENTIAL YIELD OF SNOW CRABS IN THE GULF OF ALASKA

The estimates of the snow crab resource in the Gulf of Alaska are quite optimistic but are based on a minimum of information. Pereyra (1966) has estimated the standing stock of adult C. tanneri in the depth range between 250 and 475 fathoms off Oregon and Washington to be 4,680 tons + 1,380 tons. Alverson (1968) has estimated the standing stock of snow crabs to be approximately 300,000 tons (sexes combined) in the Gulf of Alaska.(7)

At the present time, data do not exist to estimate a reasonably accurate sustained yield in the Gulf of Alaska. However, if it is assumed that snow crabs are more abundant than king crabs in the Gulf of Alaska, it appears that perhaps 50 to 100 million pounds could be harvested annually.

In 1973, fishermen received about ten cents a pound from snow crabs. Assuming that fishermen could catch 50 to 100 million pounds of snow crabs annually, it would appear that gross revenues to fishermen would be five to ten million dollars annually. In short, the snow crab resource in the Gulf of Alaska could make an important contribution to the Alaskan economy.(7)

3. THE DUNGENESS CRAB FISHERY

INTRODUCTION

The Dungeness Crab (Cancer magister) is found in the shallow nearshore waters ranging from a northern limit of Unalaska to a southern limit in the Monterey Bay.

DISTRIBUTION

Spawn, Larvae and Juveniles

Distribution of planktonic larvae is assumed to be associated with the nearshore location of the females in late spring. Post-larval stages are most abundant "on sand bottom in inshore areas shallower than five (5) fathoms". Small crabs are commonly associated with stands of eelgrass, or masses of detached algae in the absence of eelgrass, which is believed to afford them protection. One researcher reports observing young crabs (2 to 3-3/4 inches) buried in intertidal sand in February. He also found large numbers of crabs buried in the sand of Boundary Bay oyster beds in the spring.(8)

Adults

Dungeness crabs concentrated in relatively shallow waters on the continental shelf at depths less than 50 fathoms (Table II-15). As determined by NMFS exploratory trawls from 1950-1971, they occurred frequently in the inshore waters of Prince Willia, Sound at depth zones between 10-29 fathoms. Exploratory drags conducted in the vicinity of

Cape Fairweather in the Yakutat region revealed concentration of dungeness crabs at depth intervals of 10-49 fathoms. Smaller catches were found in the southeastern Alaska and the Kodiak-Shelikof regions (Figures II-9 and II-10).(5)

The distribution of dungeness crabs taken in NMFS exploratory trawls from 1950 to 1971 are shown in Figure II-11.

Data are inadequate to ascertain the standing stock of dungeness crab resources in the Gulf. However, there are speculations that both king crab and dungeness crab may now be approaching full utilization and yields may decline unless new stocks are fished.

A number of researchers concluded that adult crabs migrate offshore during the winter months and return to the nearshore in early spring and summer months. Observations of crabs in Puget Sound also supported the existence of seasonal onshore-offshore seasonal migrations.(8)

AVERAGE CATCH OF DUNGENESS CRABS PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

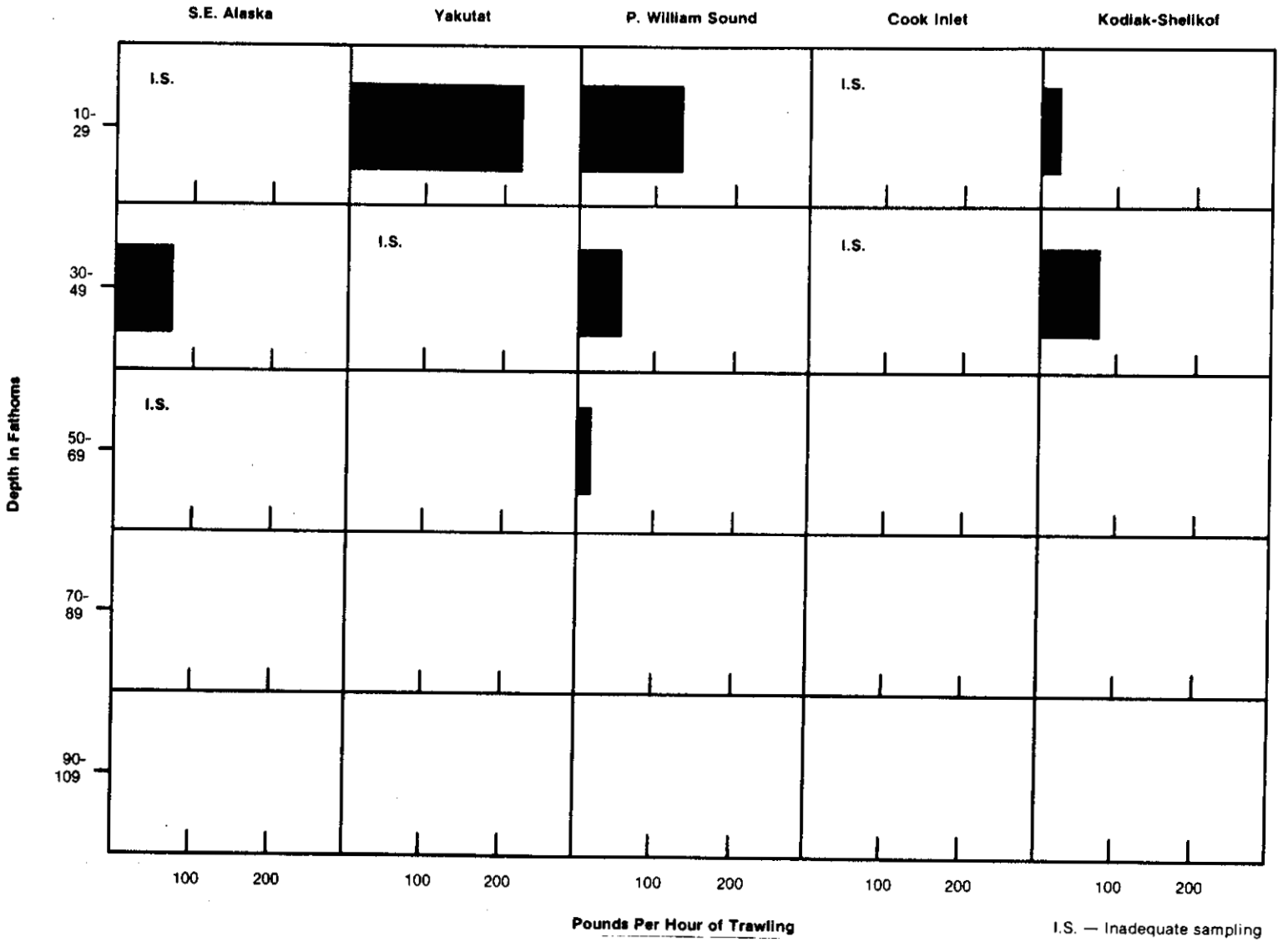


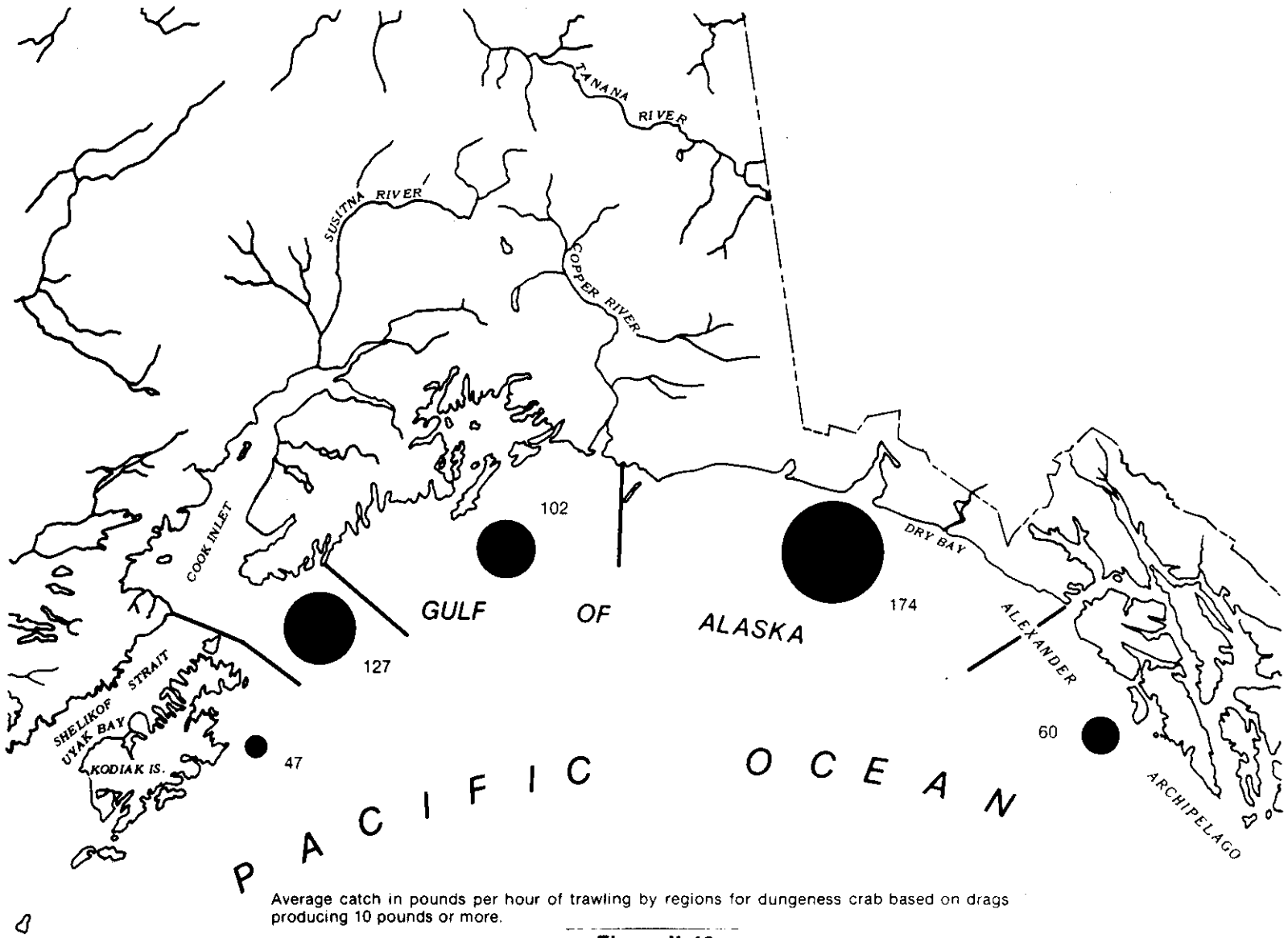
Figure II-9

Table II-15

POUNDS OF DUNGENESS CRABS CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

DEPTH FM.	S. E. ALASKA			YAKUTAT			P. W. SOUND			COOK INLET			KODIAK-SHELIKOF		
	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR
10-29	10	.1	I.S.1/	475	2.1	226	1,678	13.0	129	140	0.5	I.S.1/	86*	3.8	23
30-49	136	2.0	68	65	1.0	I.S.	214	4.0	54	25	0.8	I.S.	246*	3.3	75
50-69	10	.5	I.S.	-	-	-	38	2.0	19	-	-	-	-	-	-
TOTAL	156	2.6		540	3.1		1,930	19.0		165	1.3	-	332*	7.1	-
Avg. catch/hr. for all depths			60			174			102			127			47

1/Inadequate sampling
*Includes exploratory drag data for the period 5-31-69 to 7-25-71.



Average catch in pounds per hour of trawling by regions for dungeness crab based on drags producing 10 pounds or more.

Figure II-10

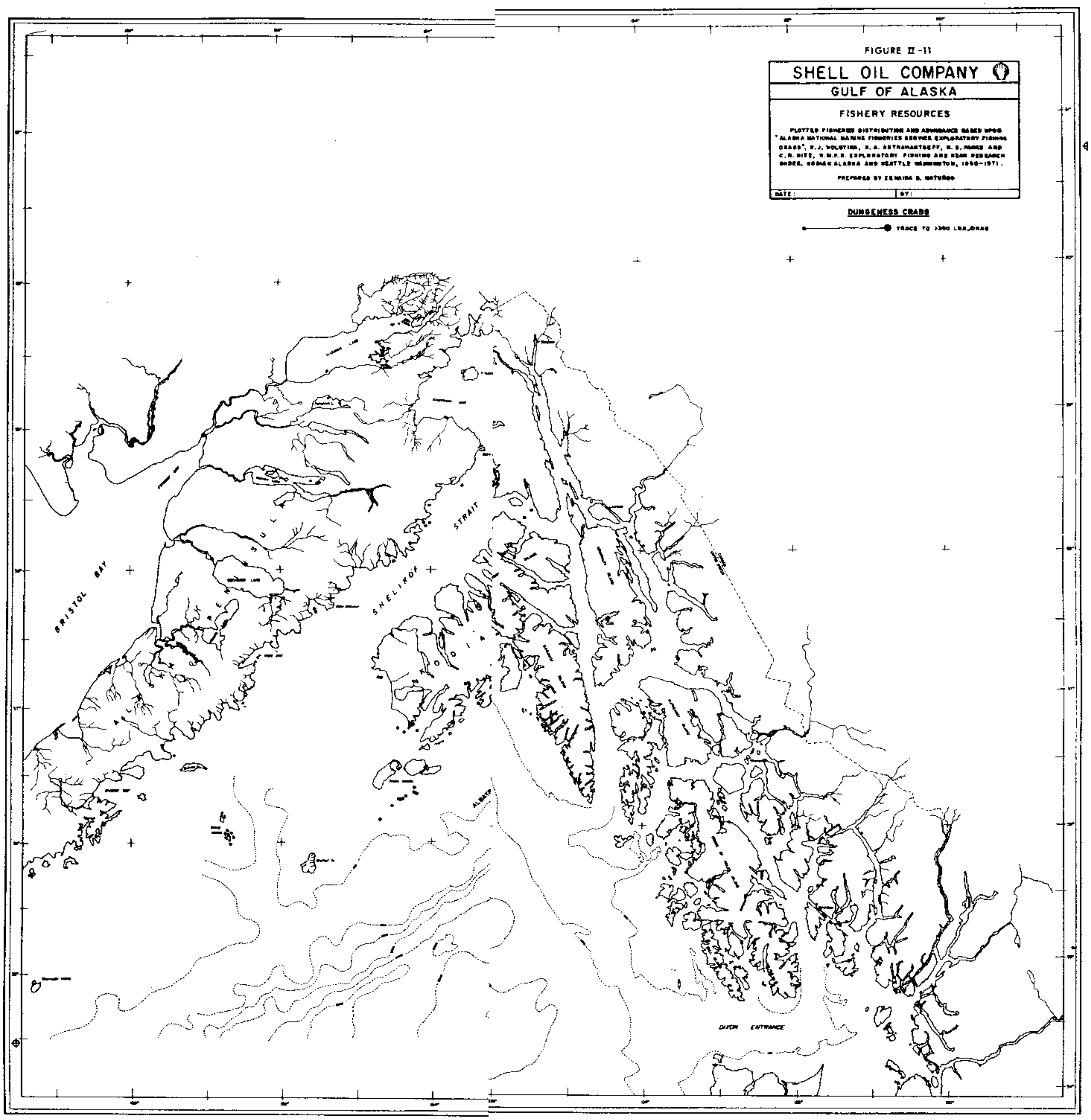


FIGURE II-11
SHELL OIL COMPANY
GULF OF ALASKA
FISHERY RESOURCES
DATE:
BY:
DUNGENESS CRABS
BRISTOL BAY
SHELIKOF STRAIT
DIXON ENTRANCE

Factors in Distribution Changes

The seasonal changes in shallow-water dungeness crab catches vary according to water temperatures and salinities. Crab abundances, estimated from catch per unit effort, increases with rising spring water temperatures and decreases with dropping fall temperatures. Changes in winter catches seem to be in response to fluctuating low salinities.(8)

NATURAL HISTORY NOTES

Spawning

Egg-bearing occurs during October to June in British Columbia. Larvae emerge from the egg masses between December and Spring in Oregon waters.(8) There appear to be no comparable data for Alaska.

Hardiness

Temperature tolerance for adult C. magister from Puget Sound has been reported. In general, no mortality was observed at temperatures below 24°C. Optimum ranges of temperature and salinity for C. magister larvae are 10.0 to 13.9°C and 24-30°/oo, respectively.

Predators

The larvae of C. magister have been found as prey items in stomachs of chinook and silver salmon taken along the coast of Oregon.

C. magister larvae are commonly found in the stomachs of salmon, herring and pilchard, sculpin, halibut, and some rockfishes. Cannibalism is common among life stages of C. magister beyond the megalops stage.(8) Large numbers of juvenile C. magister have been found in the stomachs of "wolf-eels", Anarrhichthys ocellatus, captured in crab pots.

Parasites and Diseases

The occurrence of a species of worm adhering to the carapace and among the egg masses have been reported. The worms are probably a marine leech.

A "black spot" or "rust spot" is occasionally found on the legs of C. magister.

FISHING GEAR

Rakes, hoops or rings and traps are used to take C. magister. Rakes, used to take crabs intertidally or from very shallow water, are limited to sport fishing. The method supplied a small commercial market in the past.

Ring or hoop gear is built of cotton mesh attached to two iron rings to form a collapsible basket. The inner ring, which forms the bottom of the basket, is baited and the gear lowered to the bottom. Crabs feeding on the bait are caught in the basket when the gear is

lifted. Ring or hoop gear is still used in some bays, but is has been replaced by the pot or trap in more exposed waters.

The majority of the commercial catch of C. magister is taken by the crab pot or trap. Designed after the east coast lobster pot, the trap possesses entrance tunnels with one-way doors in the openings to the trap. The traps are cylindrical and vary in diameter between 36 and 42 inches. The height averages 18 inches. Weight of the pot varies between 40 and 100 pounds, depending upon the wave action of the area fished. Pots are usually baited, commonly with cockles, Cardium corbis; razor clams, Siliqua patula; herring, Clupea pallasii; and squid, Loligo sp.(8)

Early commercial operations were conducted from small boats and skiffs. Much of the present sport fishing uses small boats or skiffs. Larger commercial boats became more numerous as the number of crab pots fished increased, and the areas fished expanded into rougher, more distant waters. Present day commercial vessels are 70 feet or longer and equipped to remain at sea.

PACIFIC FISHING AREAS: GENERAL GEOGRAPHIC DISTRIBUTION

Commercial fishing for Cancer magister takes place generally from southeastern Alaska to San Francisco. A list of areas along the Pacific coast which support this fishery is presented here.

Areas along Pacific of major commercial fisheries for Cancer magister

Alaska
- Kodiak
- Cook Inlet
- Cooper-Bering Rivers and Prince William Sound
- Southeastern Alaska

Canada
- Hecate Straits
- Dixon Entrance
- Boundary Bay
- Burrard Inlet

Washington
- Columbia River to Destruction Island
- Puget Sound

Oregon
- Columbia River to Rogue River

California
- Del Norte-Humboldt
- San Francisco
- Monterey Bay

FISHING INFORMATION

Depth Range

The majority of commercial catches of Cancer magister are from depths between 20 and 120 feet.(8)

General Pattern of Fishing Seasons

Late summer and winter moults leave the crabs in a soft-shell unmarketable condition. Fishing begins in the spring at the time shell

conditions become marketable. Offshore movement during the fall causes a reduction in fishing effort.

In Alaska, landings of Cancer magister occur year-round in areas of open season. Largest landings are usually during June and July.

Weather condition during the early season months of January through March can limit fishing effort. Weather plays a particularly important role in the coast and Alaskan fisheries. On the northernmost grounds, ice may prevent early spring fishing. Recent increases in fishing power and efficiency have tended to shorten the duration of the fishing season by enabling the fleets to capture the recruited year class in a shorter length of time.

Fishing Operations and Results

Landing records reported by the Alaska Department of Fish and Game are presented by areas for the years 1965 to 1973 in Table II-16. The largest landings are consistently from the Kodiak region. The Aleutian west of Unalaska and the Bering Sea areas are the lowest production areas. Total Gulf of Alaska landings are shown in Table .

The central area with the greatest number of pounds landed yielded the biggest dollar value to the industry. Dollar value to the fishermen has increased three to five times since 1956.(8)

Also, see Table II-17 and Figures II-12 and II-13 for all Gulf of Alaska crab landings.

Table II-16. Annual Landings of Dungeness Crab in fishing areas of the Gulf of Alaska in thousands of pounds (live weight).

Year	Southeastern Alaska	Copper-Bering Rivers & Prince William Sound	Cook Inlet	Kodiak	Chignik	South Peninsula	Aleutians East Unalaska	Aleutians West-Adak	Bering Sea
1967	4,064.6	862.3	7.2	6,663.7	--	--	--	--	--
1968	3,996.8	980.5	481.8	6,829.1	--	953.4	--	--	--
1969	2,342.4	1,413.9	48.5	5,813.7	305.6	750.7	263.4	13.0	352.7
1970	2,289.3	738.6	209.8	5,741.4	--	5.4	2.0	--	709.9
1971	1,668.7	509.8	97.2	1,445.9	5.9	5.9	5.9	--	10.3
1972	2,592.9	724.7	38.9	2,059.5	32.4	--	--	--	--
1973	3,085.9	806.3	329.9	2,000.4	--	194.5	3.0	--	2.8

Ref: (3)

Table II-17
CRAB LANDINGS IN ALASKA
1927-1973
Thousands of Pounds & Thousands of Dollars

Year	(GULF OF ALASKA) DUNGENESS CRABS		(ALL ALASKA) KING CRABS		(GULF OF ALASKA) TANNER (SNOW CRABS)	
	Quantity	Value	Quantity	Value	Quantity	Value
1927	218	20	-	-	-	-
1928	311	26	-	-	-	-
1929	399	36	-	-	-	-
1930	195	18	-	-	-	-
1931	227	21	-	-	-	-
1932	609	46	-	-	-	-
1933	1,083	78	-	-	-	-
1934	1,259	104	-	-	-	-
1935	960	82	2	-	-	-
1936	902	79	2	-	-	-
1937	1,393	138	6	-	-	-
1938	886	81	49	5	-	-
1939	581	46	13	1	-	-
1940	618	43	10	1	-	-
1941	746	16	50	1	-	-
1942	690	23	75	2	-	-
1943	691	25	45	2	-	-
1944	1,273	53	15	1	-	-
1945	1,858	60	-	-	-	-
1946	2,439	131	23	1	-	-
1947	1,393	70	753	32	-	-
1948	1,223	63	2,133	96	-	-
1949	1,429	81	1,207	72	-	-
1950	4,120	278	1,519	91	-	-
1951	5,482	478	1,994	228	12	1
1952	3,749	332	2,773	388	14	1
1953	3,472	313	4,613	547	72	7
1954	2,740	246	8,871	880	-	-
1955	4,384	374	8,163	809	1	[1]
1956	2,446	212	8,796	864	-	-
1957	552	28	13,077	1,046	-	-
1958	1,747	131	11,212	897	-	-
1959	3,999	326	18,840	1,478	-	-
1960	4,733	379	28,570	2,286	-	-
1961	4,591	442	43,412	3,941	7	1
1962	8,990	1,002	52,782	5,278	11	1
1963	12,084	1,358	78,740	7,607	-	-
1964	12,708	1,466	86,721	8,186	14	1
1965	8,895	1,000	131,671	12,729	-	-
1966	5,053	606	159,202	15,671	[1]	[1]
1967	11,598	1,507	127,716	14,970	118	12
1968	13,248	1,775	85,000	25,500	3,247	324
1969	11,304	1,620	55,800	16,700	11,200	1,100
1970	9.696	1,300	52,061	13,800	14,473	1,700
1971	3,749	610	70,703	19,077	12,880	1,368
1972	5,448	1,968	74,426	21,887	30,135	3,731
1973	6,423	3,427	76,824	44,702	61,719	10,756

[1] *Less than 500 pounds or $500.*

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

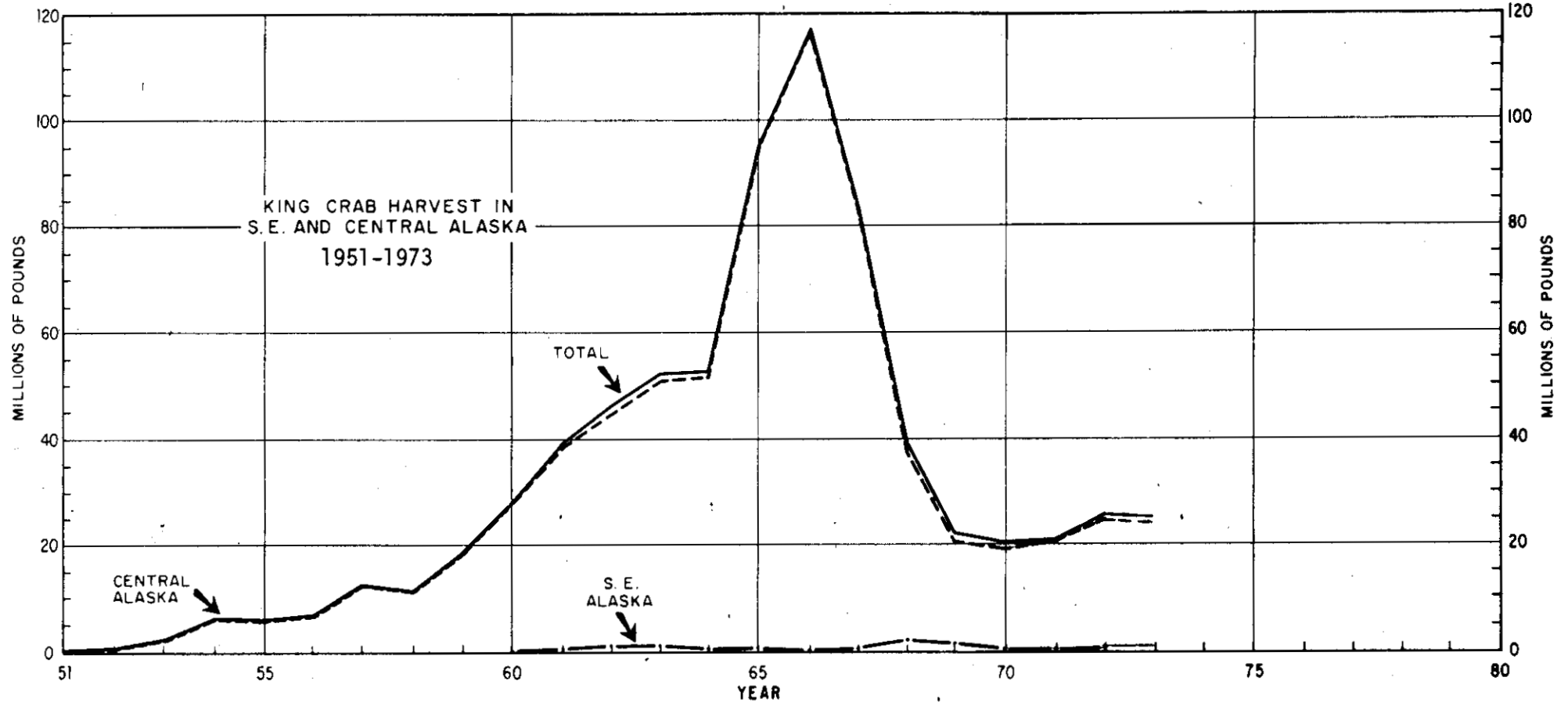


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Figure II-12

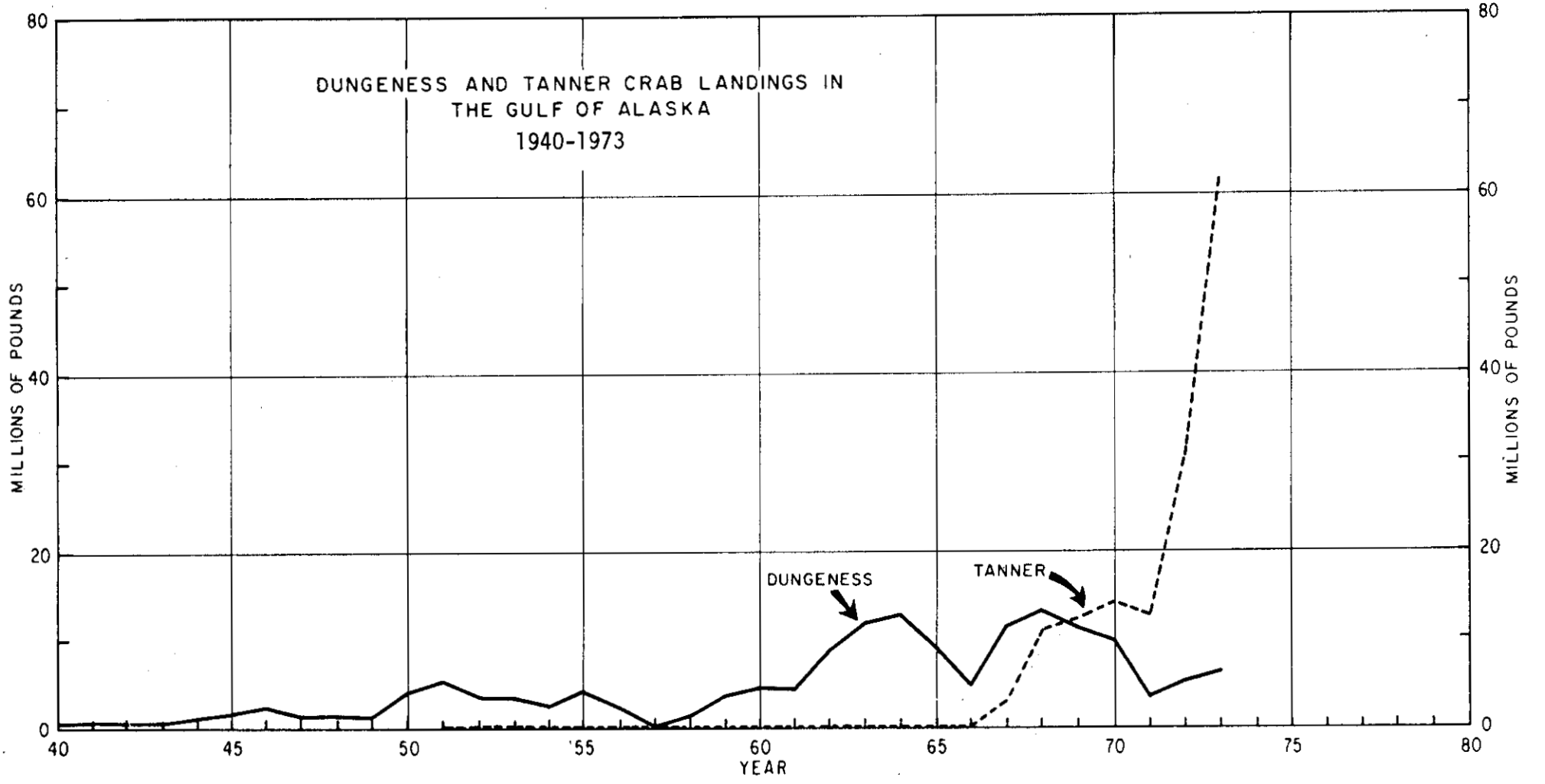

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Figure II-13

III. THE SHRIMP RESOURCES

INTRODUCTION

The shrimp fishery in the northeastern Pacific, delineated as the waters off Alaska and British Columbia, is expanding rapidly in the region. Landings have increased nearly eight-fold in the past five years, approaching 120 million pounds in 1973. The value to the fishermen was about $3.7 million. Shrimp are distributed in bays and on offshore banks throughout the northeastern Pacific and the Bering Sea. Their range extends to southern California, and fisheries occur off every Pacific state. Commercial operations consist mostly of trawling in water deeper than 90 meters while a minor fishing with baited traps also occurs.

Presently, the fisheries are in good shape biologically and economically. Projections for future expansion are excellent. One estimate predicts an annual catch of 260 million pounds worth-at current prices, over $10 million.(10)

Fourteen species of pandalid shrimps are found off the northwestern coast of North America, divided between two genera, Pandalus, and Pandalopsis.

Of these, only seven are caught by commercial fisheries in reasonable quantities or have been found to exist in commercial quantities through exploratory fishing. The seven, with their common names in parentheses, are: Pandalus borealis (pink shrimp), P. danae (dock shrimp), P. goniurus (humpy shrimp), P. hypsinotus (coonstripe shrimp), P. jordani (ocean or smooth pink shrimp), P. platyceros (spot shrimp or prawn), and Pandalopsis dispar (sidestripe shrimp). Canadian authors alternatively refer to P. danae as the coonstripe

shrimp and P. hypsinotus as the humpback shrimp. This discussion deals entirely with these seven species.(10)

DISTRIBUTION AND ABUNDANCE

Pandalus borealis has been found from the Bering Sea southward to about the Columbia River in depths of 20 to 640 meters. The greatest concentrations located by NMFS exploratory fishing from 1950 to 1971 occurred from the southeastern tip of the Kenai Peninsula, Alaska, westward along the southern side of the Aleutian chain. These explorations covered the continental shelf areas generally to depths of 183 m.

P. danae has been reported from Sitka, Alaska, southward to San Luis Obispo, California, in depths ranging from 18 to 185 m. The largest concentrations occur in depths greater than 64 m.

P. goniurus has been caught from the arctic coast of Alaska southward to Puget Sound, Washington, in depths of 5 to 183 m. Like P. borealis, the greatest concentrations were off southeastern Kodiak Island (Area C) and in the Shumagin Islands (Area F), (Figure III-1).

P. hypsinotus has been found from the Bering Sea to the Strait of Juan de Fuca in depths of 5 to 182 m, very similar to P. goniurus. The depths of greatest concentration for roughly Area B is 55 to 108 m, and for roughly Area F 73 to 145 m.

P. jordani is distributed from Unalaska Island to southern California in depths ranging from 37 m to 452 m.

P. platyceros has been reported from Unalaska Island to San Diego, California, in depths of 4 to 487 m. While the previous species are found in

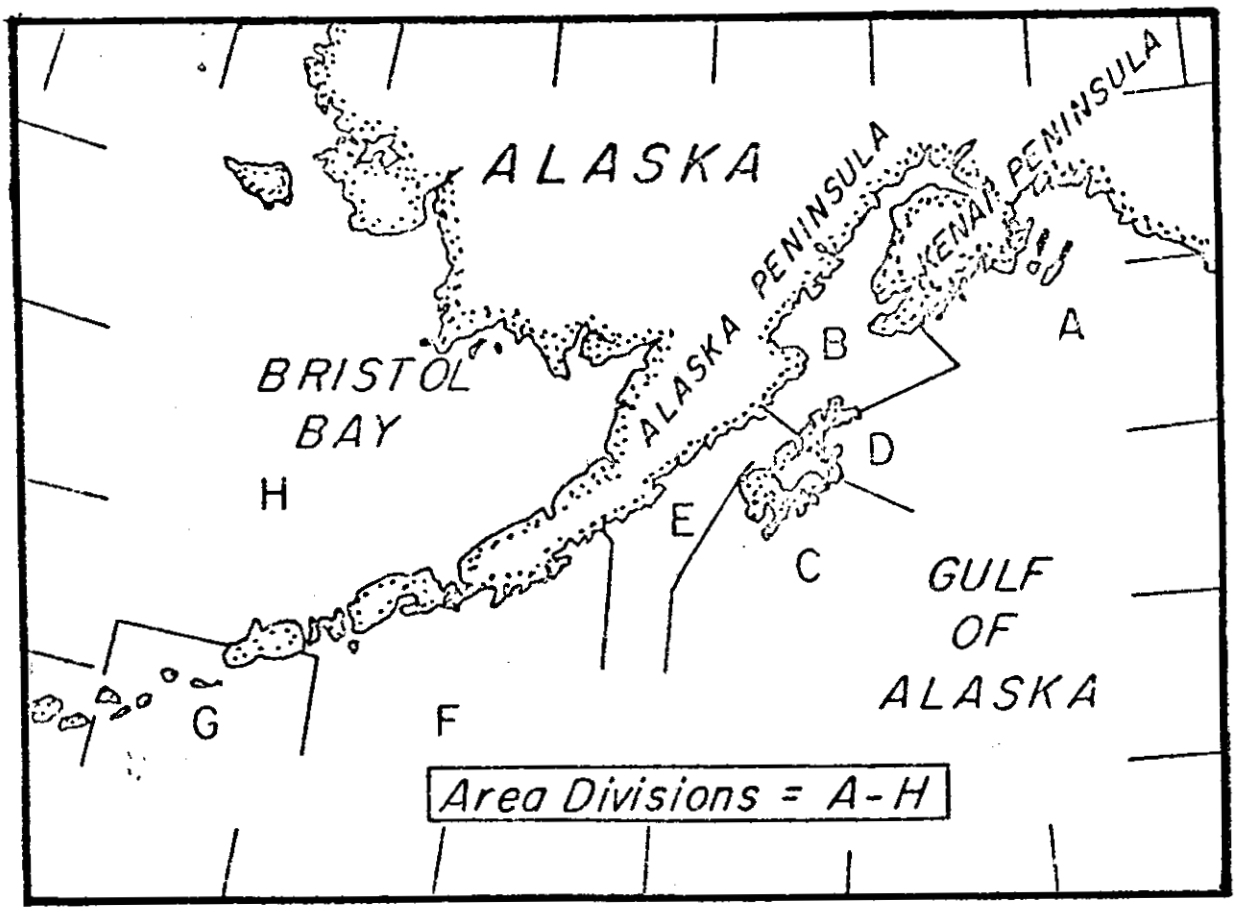


Figure III-1 Areas of shrimp exploration in the Gulf of Alaska and Bering Sea during the summers of 1962-64.

areas suitable for trawling, P. platyceros is found in rocky areas so that exploratory fishing did not locate any areas of major concentration.

Pandalopsis dispar has been captured from the Bering Sea, west of the Pribilof Islands southward to Manhattan Beach, Oregon, in depths ranging from 37 to 642 m. Next to P. borealis, it is the most abundant shrimp north of British Columbia. For southeastern Alaska, the greatest concentrations are in Idaho Inlet and Port Snettisham. The greatest concentrations of Pandalopsis dispar are somewhat deeper than P. borealis, generally from 110 to 210 m.(10)

The pink (Pandalus borealis), side-stripe (Pandalopsis dispar), spot (Pandalus platyceros), and coon-stripe (Pandalus hypsinotus) shrimp were the most frequently encountered species in Bureau of Commercial Fisheries exploratory trawls conducted in the Gulf of Alaska. Pink shrimp dominated the shrimp trawl catches followed by side-stripe and coon-stripe shrimp. Pink shrimp made up about 73 percent of shrimp catches for the entire Gulf of Alaska regions. About 86 percent of shrimp catches in Prince William Sound area alone were pink shrimp.(5)

The relative abundance of shrimp increased progressing north and west towards Kodiak Island (Figure III-2). Explorations of the passages and bays in southeastern Alaska revealed commercial concentrations of pink shrimp in Glacier Bay, Stephens Passage, Lynn Canal, Idaho Inlet, and Keku Strait (see map). Best catches were made between 30-89 fathoms in all regions explored. The highest catch rate, based on average catch per hour of trawling for shrimp consistently occurred in the 30-49 fathom depth interval in all regions (Table III-1). The highest single catch of shrimp (13,450 lbs.) occurred at depth range of 78-83 fathoms in Uganik Bay in Kodiak Island. The Kodiak-Sheilikof region

provides the major source for commercial shrimp fishing. Good catches were made at 30-109 fathom intervals in bays and inlets, as well as the offshore waters of the continental slope from Prince William Sound to the west end of Kodiak Island. In the Yakutat area, shrimp were only found in Yakutat Bay where they were relatively abundant at depth range of 30-49 fathoms (Figure III-3).(5)

Abundance and distribution of shrimp taken in NMFS exploratory trawls are shown in Figure III-4.

AVERAGE CATCH OF SHRIMP PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

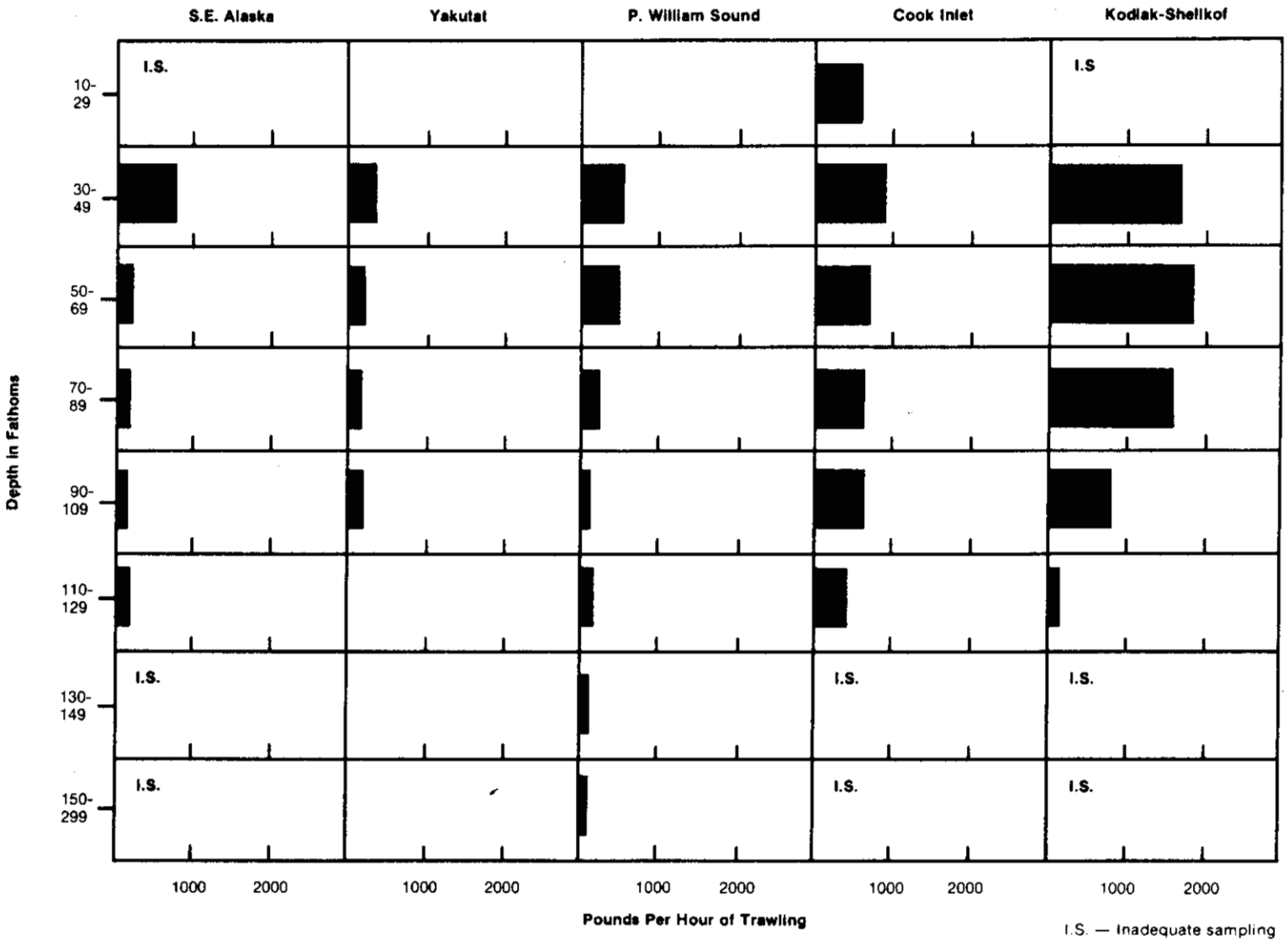


Figure III-2

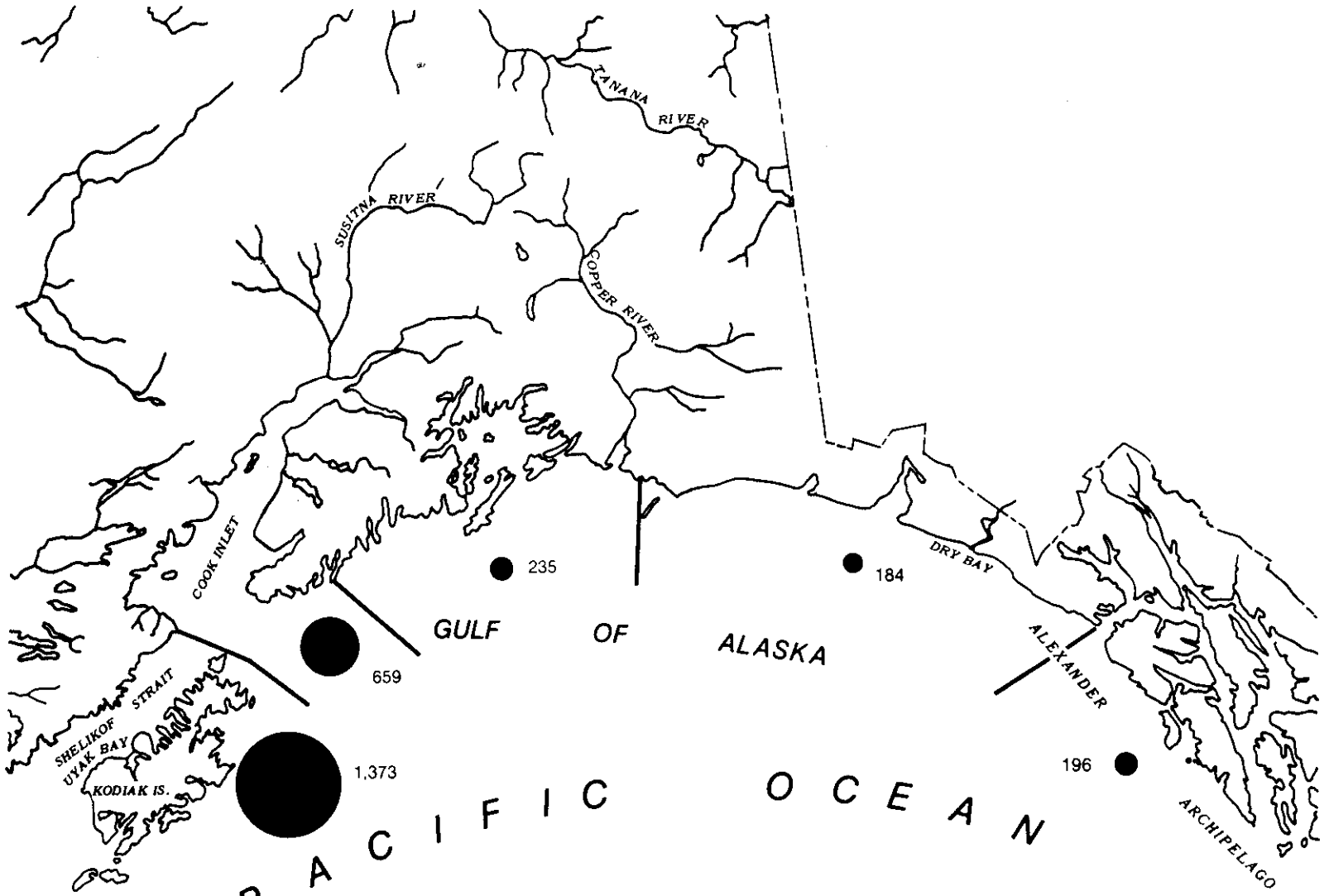
Table III-1

POUNDS OF SHRIMP CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

	S. E. ALASKA			YAKUTAT			P. W. SOUND			COOK INLET			KODIAK-SHELIKOF		
DEPTH FM.	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR
10-29	547	1.6	I.S.[1/]	-	-	-	-	-	-	1,572	3.0	524	560	1.0	I.S.[1/]
30-49	8,049	22.2	362	2,173	7.0	310	2,292	4.7	488	5,998*	6.4	937	33,323	19.0	1,754
50-69	6,067	33.9	179	1,356	7.7	176	12,030*	28.1	428	8,451*	10.1	837	62,047*	31.4	1,976
70-89	5,111	33.3	153	1,353	11.0	123	11,424*	47.2	242	11,344*	19.4	585	102,834*	71.1	1,446
90-109	2,162	17.5	124	395	3.0	132	5,171*	40.4	128	1,589*	2.7	589	27,128*	30.7	884
110-129	537	4.0	134	-	-	-	1,520*	10.5	144	1,137*	3.5	325	1,123	9.0	125
130-149	71	1.5	I.S.	-	-	-	585	5.8	101	690	1.4	I.S.	214	1.5	I.S.
150-299	56	1.2	I.S.	-	-	-	330*	5.5	60	532	1.0	I.S.	273	2.0	I.S.
TOTAL	22,600	115.2		5,277	28.7		33,352*	142.2		31,313*	47.5		227,502*	165.7	
Avg. catch/hr for all depths			196			184			235			659			1,373

[1/] Inadequate sampling

*Includes exploratory drag data for the period 5-31-69 to 7-25-71.



Average catch in pounds per hour of trawling by regions for shrimp based on drags producing 10 pounds or more.

Figure III-3

FIGURE III-4

SHELL OIL COMPANY

GULF OF ALASKA

FISHERY RESOURCES

PLOTTED FISHERIES DISTRIBUTION AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING DRAGS", R. A. WOLOTIRA, S. A. ASTRAKHANTSEFF, H. S. PARKS AND C. R. HITZ, N.M.F.S. EXPLORATORY FISHING AND BEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1960-1968.

PREPARED BY ZENAIDA D. MATURGO

DATE: | BY:

SHRIMP

● — TRACE (<10 LBS.)

●— > 5000 LBS.

1969-1971

○——○ TRACE TO >5000 LBS./DRAG

PRINCE WILLIAM SOUND

FAIRWEATHER GROUND

ALEUTIAN TRENCH

GULF OF ALASKA

NATURAL HISTORY NOTES

Environment

Most pandalid shrimps occupy mud or sand and mud-mixed bottoms. However, they do not occur in all areas where such sea-floors occur. References to green mud bottoms in relation to large concentrations of P. borealis and P. jordani have been made by many authors who infer that the organic content of the bottom is more important in determining distribution than bottom consistency. Most sampling has been conducted with trawls, which work well only on the type of bottom described above. It is, therefore, inconclusive whether or not many pandalids concentrate on harder or rockier bottoms.(10)

On the basis of temperature, P. borealis and P. jordani are diametrically opposed, with P. borealis concentrating in colder water. The other species are not so easily delimited.

P. jordani tolerates the highest salinity range, 28.7 to 34.6°/oo, and P. borealis the lowest, 23.4 to 30.8°/oo. The remaining ranges reported are P. danae, 25.2 to 30.1°/oo; P. hypsinotus, 25.9 to 30.6°/oo; P. platyceros, 26.4 to 30.8°/oo; and Pandalopsis dispar, 26.7 to 30.8°/oo.

Migrations

Pandalid shrimps undergo onshore-offshore migrations, coastwise movement, and vertical migrations in the water column. Migration associated with age has been documented for P. borealis, P. hypsinotus, P. platyceros and Pandalopsis dispar. Freshly hatched larvae have been found in or near the vicinity of the spawned adults. At about the third stage of development, larvae were found segreated in shallower water 9 to 64 m (or, in the case of Pandalopsis dispar,

not located at all) where they spent their first summer. Then during their first winter, they joined the adult population in deeper water. This was not the case for P. danae, and juvenile P. jordani are found among the adults.[10]

Diel vertical migrations are common among some pandalids. In Kachemak Bay, many P. borealis leave the bottom during late afternoon or evening and return to near, or on, the bottom about dawn.[16] The period of time that shrimp remain away from the vicinity of the bottom varies directly with the season's number of hours of darkness. Diel migrations are possibly related to feeding behavior, since shrimp feed mainly on euphausiids and copepods which also make diel migrations. These movements may be evolutionary protection and dispersal mechanisms.[10]

Biology

The general life histories of the seven pandalid shrimps are nearly the same. Difference occur in timing which are related to the geographical location of the population and to a given species.

Reproduction

Spawning may occur from late September through mid-october. Females carry their eggs externally until hatching, a habit which is unlike that of the other major family of exploited shrimp (Penaeidae) and of many species of fishes. Hatching occurs mainly from March through April. The lengths of spawning, carrying and hatching periods vary inversely with the temperature of the environment, at least for P. borealis. Laboratory studies revealed that most larvae hatch at night. Hatching an entire clutch of eggs may take as long as two days, and the female molts out of breeding dress within two weeks.[10]

Early larvae stages have been found on or about the spawning beds. There are no published reports of finding larvae in surface waters, which indicate that in the absence of strong mid-water or bottom currents, larval drift may not occur to any appreciable degree. However, the time of day that the surveys were made may be important since it is known that mid-water zooplankton, of which shrimp larvae are presumably a part, perform diel migrations, rising near the surface during the hours of darkness. The larvae remain planktonic for about two to three months, passing through six stages to become juveniles, and then settle, taking up a benthonic existence like the adults.(10)

Mortality and Predation

Pandalid shrimp experiences high mortality rates. Virtually no P. borealis survice to be seven years of age off the Pacific coast, and this is probably true for the other pandalids. Estimates of annual survival rates for P. jordani off California ranged from 52 to 30 percent for the years 1960-1966. These estimates were made in the presence of a fishery, so they represent both natural and fishing mortality.

Virtually any large fish in their vicinity is a potential predator of shrimp. Those noted as feeding on shrimp include the Pacific hake, Pacific cod, sablefish, lingcod, arrowtooth flounder, petrale sole, yellowfin sole, rock sole, flathead sole, various rockfishes (Sebastes sp.), spiny dogfish, skates and rays (Raja sp.) Pacific halibut, salmon and harbor seals.(10)

Food and Feeding

Stomach contents of 50 specimens each of P. borealis, P. danae, P. hypsinotus, P. platyceros and Pandulopsis dispar characterized these pandalids

as carnivorous bottom-feeders whose foods are marine worms and small crustaceans. Only two stomachs examined contained plant matter and little evidence of scavenging activity. Shrimp are caught with pots baited with dead animal material, which indicates scavenging inclination.(10)

Diseases and Parasites

Little is known about the disease and parasites of pandalid shrimps. A condition in P. borealis off Maine is termed the black spot gill disease. This disease results in destruction of gill lamellae and in formation of a chitinous growth over the damaged area producing a black spot. A similar condition has been observed on a few specimens of P. borealis caught off Kodiak Island in outer Marmot Bay south of Marmot Island during September 1971.

Most species of pandalid shrimps are parasitized to some degree by bopyroid isopods (Bopyrus sp.). These isopods, a large female and the smaller male together, attach in the gill area, and the shrimp's carapace forms around them after molting to produce a characteristic "bubble".(10)

EXPLOITATION

Pandalid shrimps support fisheries throughout northern temperature and boreal waters of the world. Off North America, these shrimps are landed in Maine and Alaska south to central California. United States Pacific Coast landings totaled 1,443 million pounds in 1973.(2) More than 82 percent of the catch was taken in Alaskan waters(3) with the remainder coming from Oregon, California and Washington. Current estimates of total Japanese and Russian catches off Alaska are not available. They are thought to be substantial,

with an estimated 62.3 million pounds taken from around Kodiak Island alone in 1970.[10] Total U.S. Gulf shrimp landings are shown in Table III-5 and in Figure III-5. The principal areas fished are shown in Figure III-6.

ALASKA SHRIMP FISHERY

Southeastern Alaska Fishery

The fishery uses primarily beam trawls with beams 32 to 52 feet wide holding the net open. Vessels 37 to 56 feet long make daily trips catching up to 10,000 pounds per day. There are two processors listed for 1970 in the Petersburg-Wrangell area. The landings for 1959 were 1.7 million pounds,[1,3] but declined to 711,000 pounds in 1973.

Cook Inlet Fishery

This region, including Homer and Kasilof, had three processors in 1970. Fishing activity in this area now exceeds that of southeastern Alaska as landings for 1973 were 4.8 million pounds. The major location of fishing is in Kachemak Bay.[10]

Kodiak Island Fishery

The waters around Kodiak Island produce most of Alaska's landings (Table III-2) and over two-thirds of the total Pacific coast landings. Nearly all the landings in this region are made with semi-ballon otters trawls with 1½ inch stretch mesh nets. The average net size is much greater than earlier nets, with many over 100 feet wide. The vessels are much larger than those reported for southeastern Alaska ranging from 54 to 100 feet long. Most of the vessels are rigged to fur one net. Some boats are now double rigged towing two 70 to 80 foot nets at a time. Catches of 20,000 pounds for an hour tow are not uncommon for these double riggers. Trips usually last three days

producing loads of 60,000 pounds. One vessel, double rigged and possessing a stern ramp, caught 140,000 pounds in a day and a half of fishing.

Up to eight drags per day may be made in good weather during the summer months. Fishing is done entirely during the daylight hours because of the diel movement of the shrimp.

Most of the catch is P. borealis with P. goniurus and Pandalopsis dispar contributing nearly all the remainder.

In 1960, the major areas fished were inner Marmot Bay (21 percent), Ugak Bay (10 percent), Sitkalidak Strait (45 percent), and Alitak Bay (17 percent) (Jackson, 1968). Fishing has since concentrated in Twoheaded Gully, Kiliuda Bay and Ugak Bay where combined they produced 75 to 85 percent of the Kodiak catch in 1968-1970 (Table III-3). Especially explosive has been the rise of Twoheaded Gully from 18 percent in 1968 to nearly 49 percent in 1970. Other areas fished in 1970 include Alitak Bay (1.5 percent), N. Afognak Island (2.5 percent), Shelikof Strait (0.9 percent), Chiniak Bay (0.8 percent), Kukak Bay (1.9 percent), Malina Bay (2.0 percent), Marmot Bay (4.2 percent), Sitkinak Strait (0.2 percent), Ugak Bay (0.4 percent), and Vickoda Bay (1.1 percent).(10)

The state of the stocks in the three major areas may be examined with the aid of the catches per hour (lbs/hr) for the years 1968, 1969 and 1970 (Table III-4). The greatest density of shrimp appears to be Twoheaded Gully, with Kiliuda and Ugak Bays nearly similar. There appears to be no trend to indicate that the stocks are suffering any decline due to heavy fishing. However, Table III-4 is not adjusted for an increase in the average net width mentioned previously. If such a correction were introduced, the later catch rates would be reduced as much as 25 percent below the 1968 level.(10)

The Kodiak Advisory Committee, consisting of industry representatives, in 1970 recommended the establishment of quotas for shrimp caught around Kodiak Island during 1971. The industry is apparently concerned about the rapid expansion of the fishery after the recent boom and bust of the area king crab fishery. The Alaska Department of Fish and Game established a system of quarterly quotas based on past catch records for 1971. Several traditional areas achieved their quotas and were closed. Landings in 1973 are substantially greater than 1970, but with the area closures, the increase is almost entirely from new areas.

TABLE III-2

Pandalid shrimp landings (thousand of pounds) in Alaska with Kodiak contribution, 1959 - 1971.

YEAR	ALASKA TOTAL CATCH IN 1000's LBS.	KODIAK DISTRICT CATCH IN 1000's LBS.	KODIAK PERCENT
1959	13,052	2,897	22.2
1960	7,436	3,379	45.4
1961	15,981	11,084	69.4
1962	16,943	12,654	74.7
1963	15,127	10,118	66.9
1964	7,727	3,947	51.1
1965	16,819	13,810	82.1
1966	28,193	24,097	85.5
1967	41,813	38,723	92.6
1968	42,077	34,097	82.0
1969	47,850	41,298	86.3
1970	74,000	62,369	84.3
1971	94,891	82,152	86.6
1972	83,830	58,352	69.5
1973	119,963	70,511	58.0(1,3)

TABLE III-3

Total shrimp landings (lbs.) from three major areas of Kodiak Island, 1968-1969[16]

	1968		1969		1970	
Area	lbs.	% of Total Catch	lbs.	% of Total Catch	lbs.	% of Total Catch
Two-headed Gully	6,221,538	18.0 //	17,488,935	42.3 //	30,426,956	48.8
Kiliuda Bay	7,434,251	21.6 //	6,096,949	14.8 //	7,369,853	11.8
Ugak Bay	12,351,153	35.8 //	8,829,142	21.4 //	14,925,889	23.9

TABLE III-4

Shrimp catch (lbs.) per hour for the major Kodiak catch areas, 1968-1970[16]

Area	1968	1969	1970
Two-headed Gully	4,104	4,401	5,604
Kiliuda Bay	3,834	3,350	4,269
Ugak Bay	3,380	3,455	3,879

Alaska Peninsula Fishery

One processor is listed for 1970 in the Alaska Peninsula region. Catches were reported from the Chignik Bay area, and a catch of 5.3 million pounds was reported for 1970 in the Shumagin Islands region. Most of the catch came from Balboa Bay-Unga Strait (47 percent), Pavlov Bay (34 percent) and Mitrofania Island (17 percent).

RESOURCE PROGNOSIS

The general outlook for the pandalid shrimp resource of the Northeastern Pacific is excellent. A standing biomass of pandalid shrimp on the Alaskan continental shelf from Cape Spencer to Unimak Pass has been calculated at 1,800 million pounds. The stocks in the Northeastern Pacific may yield equal to, or greater than 260 million pounds annually. With current landings at about one-third of that, and by expanding into the Shumagin Islands where exploratory fishing has indicated the greatest densities occur, the estimate quite likely will be attained. With only two years of data currently available, however, it is not known whether this level of exploitation is indefinitely sustainable.(10)

Table III-5

GULF OF ALASKA
SHRIMP LANDINGS
1916-1973
Thousands of Pounds & Thousands of Dollars

Year	Quantity	Value
1916	164	-
1917	114	-
1918	361	-
1919	375	-
1920	700	-
1921	2,156	-
1922	2,102	-
1923	2,878	-
1924	3,303	-
1925	3,247	-
1926	3,064	-
1927	3,074	-
1928	3,152	-
1929	3,111	40
1930	3,198	42
1931	2,863	37
1932	1,876	23
1933	1,985	20
1934	2,367	24
1935	2,355	26
1936	2,967	32
1937	2,886	33
1938	2,721	34
1939	2,735	-
1940	3,164	-
1941	2,770	82
1942	1,896	8
1943	713	7
1944	879	8
1945	1,344	24
1946	2,168	56
1947	2,080	214
1948	3,021	227
1949	3,148	181
1950	2,980	173
1951	2,580	179
1952	2,942	182
1953	2,881	225
1954	2,635	189
1955	3,272	238
1956	3,428	396
1957	4,114	309
1958	7,862	278
1959	13,052	506
1960	7,436	297
1961	15,980	639
1962	16,943	732
1963	15,127	605
1964	7,727	309
1965	16,819	757
1966	28,193	1,288
1967	41,813	1,700
1968	42,077	1,861

Table III-5 (Continued)

Year	Quantity	Value
1969	47,850	1,909
1970	74,336	2,947
1971	94,891	3,909
1972	83,735	4,488
1973	119,507	3,928

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

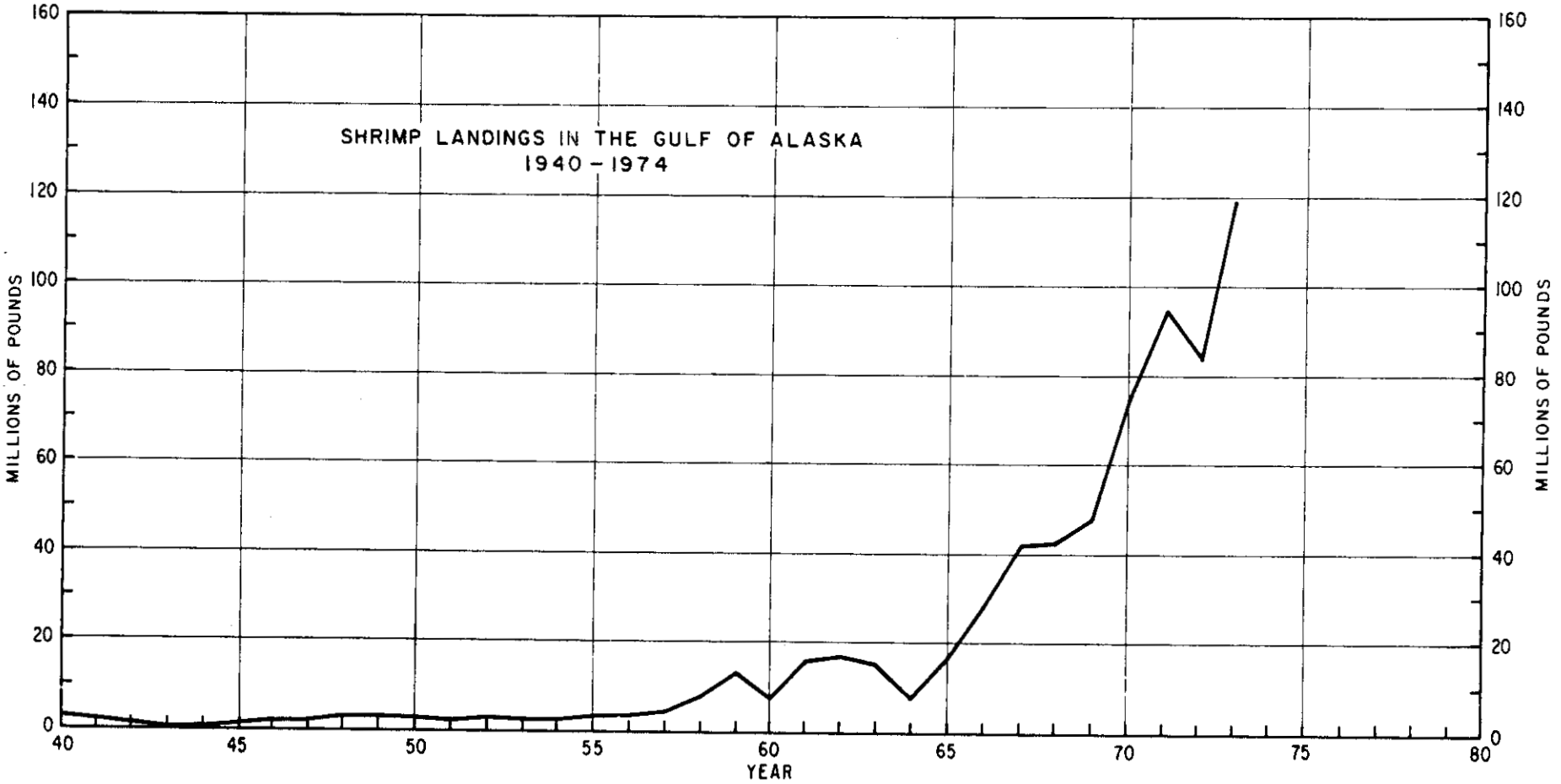

SHRIMP LANDINGS IN THE GULF OF ALASKA
1940 - 1974
MILLIONS OF POUNDS
MILLIONS OF POUNDS
YEAR
0
20
40
60
80
100
120
140
160
40
45
50
55
60
65
70
75
80

Figure III-5

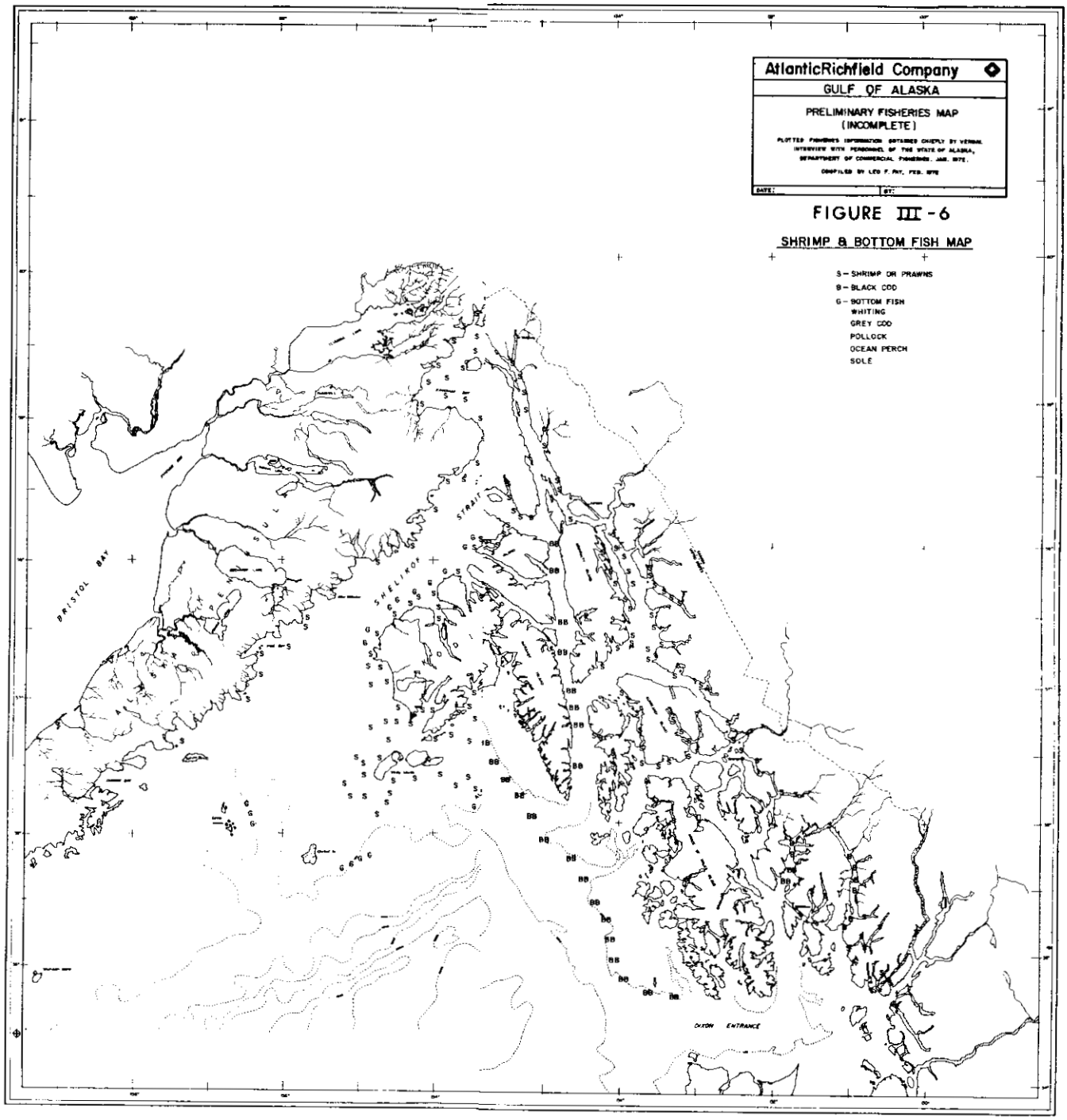


FIGURE III-6

SHRIMP & BOTTOM FISH MAP

IV. THE MOLLUSK RESOURCES

1. THE WEATHERVANE SCALLOP FISHERY

INTRODUCTION

One of the newly established commercial fisheries in the Gulf of Alaska is that for the weathervane sea scallop, Patinopecten caurinus. A number of surveys conducted during the 1950's and 1960's indicated that beds of scallops were present in both the Yakutat and Kodiak Island areas. However, it was not until 1967 that any attempt was made to exploit this resource. In December, 1967, a small commercial fishery was established off Kodiak, Alaska.(11)

DISTRIBUTION

Although small numbers of weathervane scallops have been taken incidentally in other fisheries from California to Alaska, the commercial fishery for this species is centered in the Kodiak Island and Cape Fairweather to Cape St. Elias area (Yakutat region) of the Gulf of Alaska. (See Figure IV-5)

NATURAL HISTORY NOTES

Scallops spawn only during June and early July, and probably only one annual spawning occurs. Changes in temperature may be the mechanism that triggers spawning. Sea scallops are most abundant in depths between 30 and 70 fathoms.

SCALLOP FISHERY

Commercial scallop landings from 1967 to 1970 showed that, although catches were relatively small, the dollar return to fishermen was quite substantial. In 1973, landings of 1.1 million pounds of Gulf scallop meats brought revenues to fishermen value at 1.3 million dollars.

An annual harvest of scallop meats in Alaska of 1 to 1.5 million pounds appear feasible. This estimate is based on evidence available in 1969. The decline in landings which occurred in 1971 may indicate that this estimate is too high, despite the 1.1 million pound landing in 1973. Thus, it may be that annual landings will eventually stabilize at a level between 0.5 and 1.0 million pounds of shucked meat with an occasional higher figure when an unusually strong year class enters the fishery. It is also possible that over-fishing will adversely affect recruitment which could result in annual landings of less than 0.5 million pounds.[11] If fishing does, in fact, have an adverse effect on recruitment, the level of landings may drop substantially. That this may occur is suggested by the prolonged period of low catches of sea scallops, Pacopecten magellanicus, from Georges Bank on the east coast of the United States.[11]

ABUNDANCE AND DENSITY OF SCALLOPS IN GULF OF ALASKA

Surveys have revealed no extensive beds of scallops in either the Bering Sea or the Alaska Peninsula area. Commercial quantities of weathervane scallops do not appear to be present in waters off Oregon. Thus, it appears that the Kodiak Island and Yakutat areas, where the fishery is currently being prosecuted, are the only regions that can support commercial fisheries for scallops in the Gulf of Alaska.

Haynes and Powell (1968) presented a summary of catches of sea scallops taken in various surveys in the Gulf of Alaska from 1953-1964. Their data are shown in Tables IV-1 and IV-2, and represent the type of data that are available to make estimates of scallop abundance.

This type of data can be very useful in determining the relative abundance of organisms according to depth, time of year and locations. However, surveys usually are not very useful in determining either the absolute abundance or the changes in absolute abundance of an organism because they are not conducted in a systematic fashion.

NATIONAL MARINE FISHERIES SERVICE (BCF) EXPLORATORY TRAWLS

In exploratory trawls conducted by the Bureau of Commercial Fisheries (predecessor agency to NMFS) from 1950-1971, best catches were made in depths between 30 and 70 fathoms (Table IV-3). The areas of best catches included Cape Fairweather, off Icy Bay, and east of Cape St. Elias, all located in the Yakutat region (Figures IV-1 and IV-2). Sea scallops were also successfully dredged in Marmot Bay and Stevenson entrance off Kodiak Island and trace amounts were observed off lower Kenai Peninsula and Shelikof Strait.(5)

Exploratory drags made off Kodiak Island during the 1969-1971 period revealed a great abundance of scallops in the Marmot and Ugak Bay areas where a record catch of 775 lbs. was dredged off Ugak Island in 0.6 hr. at 40-45 fathoms. Due to several high catches, the average catch per hour for this species in Kodiak-Shelikof region jumped from 99 lbs. (1950-1968) to 375 lbs. (1969-1971), exceeding the Yakutat region average catch by 134%.(5)

In summary, data from the various surveys undertaken in the Gulf of Alaska indicate that the resource is relatively small although a limited fishery probably could operate very profitably in this area.

Another source of data concerning the extent of the scallop resource in the Gulf of Alaska is the commercial fishery. Table IV-4 shows the annual catch and value to fishermen of scallops landed in Alaska. These data show that, although landings of scallops are relatively small, the return to fishermen is quite substantial. Table IV-4 also shows that landings of scallops have declined since 1969. This suggests that the fishery has essentially exploited the accumulation of older scallops and is now relying on individuals recruited into the fishery annually. If this is the case, catches may vary directly with the strength of the fishery.(11)

TABLE IV-1

Summary of catches of sea scallops in the Gulf of Alaska, 1953-1964.

Vessel or Agency	Date Month	Year	No. of Stations	Catch of Sea Scallops	Greatest Catch of Sea Scallops /Tow	Fishing Area	Gear
Paragon	June-Sept.	1964	67	13 bushels	4 bushels	Chiniak and Marmot Bays, Shumagin Islands and south side of Unimak Is.	New Bedford type scallop dredge
Yaquina	July-August	1963	8	1 bushel	1 bushel	Off Seal Rocks & Kukak Bay in Shelikof Strait	New Bedford type scallop
Manning	May-June	1963	82	103 bushels	7 bushels	Cape St. Elias to Cape Fairweather	New Bedford type scallop dredge
Yaquina	July-Nov.	1962	215	509 scallops	360 scallops	Chatham Strait to Portlock Bank	400 mesh otter trawl, 40- and 70-foot shrimp trawls and 40-foot flat trawls
Int. Pacific Halibut Comm.	May-April	1961 1963	1,272	7,316 scallops	1,500 scallops	Unimak Pass to Cape Spencer	Otter trawls

Tordenskjold	June-Sept.	1961	232	2,356 scallops	1,000 scallops	Cape Spencer to Cape Douglas	Otter trawls
New Hope	Sept.-Oct.	1960	37	501 scallops	300 scallops	Cape Muzon to Cape Ommaney; off Cape Fairweather	Otter trawls
John N. Cobb	Sept.-May	1961 1962	135	76 scallops	24 scallops	Cape St. Elias to Blying Sound; Seward Gully and Albatross Gully	Otter trawls
Afognak	Aug.-Aug.	1953 1954	unknown	1,000 scallops	unknown	Kodiak Island-Shelikof Strait	New Bedford type scallop dredge
John N. Cobb	March-April	1953	79	392 scallops	49 scallops	Yakutat Bay and off Ocean Cape	New Bedford type scallop dredge, small otter trawl, 20-ft. beam trawl, shrimp traps and crab traps
TOTALS			2,127	117 bushels plus 12,150 scallops			

(From Eldridge)

Source: Haynes, E. B. and B. C. Powell. 1968. A preliminary report on the Alaska sea scallop fishery exploration, biology, and commercial processing. Alaska Dept. of Fish and Game. Info. leaflet 125: 20 p.

TABLE IV-2 Summary of the locations and quantity of sea scallops in best catches during exploratory cruises in the Gulf of Alaska, 1953-1964.

Location Lat.	N.	Long.	W.	Quantity of Scallops	Date	Maximum Depth (fathoms)	Gear	Vessel
58°	48'	138°	05'	200 scallops	9/20/60	35	trawl	New Hope
58°	51'	138°	06'	300 scallops	9/20/60	44	trawl	New Hope
58°	49'	138°	08'	600 scallops	10/2/62	41	trawl	Arthur H
58°	50'	138°	09'	1,500 scallops	6/24/62	39	trawl	Arthur H
59°	19'	139°	25'	231 scallops	7/15/61	60	trawl	Tordenskjold
59°	26'	139°	50'	350 scallops	10/17/62	68	trawl	Arthur H
59°	40'	141°	30'	204 scallops	7/28/61	50	trawl	Tordenskjold
59°	49'	141°	45'	6 bushels	6/8/63	42	dredge	Manning
59°	46'	141°	50'	855 scallops	7/13/62	43	trawl	Arthur H
59°	48'	141°	52'	190 scallops	1/27/63	52	trawl	Western Flyer
59°	50'	141°	55'	4 bushels	6/8/63	41	dredge	Manning
60°	00'	142°	59'	6 bushels	6/9/63	62	dredge	Manning
60°	01'	142°	59'	300 scallops	9/6/61	74	trawl	Tordenskjold
60°	00'	143°	06'	5 bushels	6/9/63	57	dredge	Manning
59°	53'	144°	01'	166 scallops	9/1/61	51	trawl	Tordenskjold
59°	45'	144°	04'	1,075 scallops	7/21/62	56	trawl	Arthur H
59°	48'	144°	04'	5 bushels	6/10/63	55	dredge	Manning
59°	45'	144°	16'	1,000 scallops	9/3/61	62	trawl	Tordenskjold
59°	46'	144°	16'	360 scallops	10/2/62	62	trawl	Yaquina
59°	44'	144°	17'	374 scallops	7/21/62	64	trawl	Arthur H
59°	45'	144°	17'	280 scallops	1/30/63	61	trawl	Western Flyer
59°	41'	144°	33'	188 scallops	7/23/62	77	trawl	Arthur H
59°	37'	145°	20'	160 scallops	9/17/62	65	trawl	Western Flyer
59°	39'	145°	30'	400 scallops	7/28/62	68	trawl	Arthur H
57°	24'	150°	58'	225 scallops	7/26/61	54	trawl	Arthur H
57°	54'	151°	30'	161 scallops	7/27/61	46	trawl	St. Michael
58°	04'	151°	58'	4 bushels	6/24/64	69	dredge	Paragon

(From Eldridge)

Source: Haynes, E. B. and B. C. Powell. 1968. A preliminary report on the Alaska sea scallop fishery exploration, biology, and commercial processing. Alaska Dept. of Fish and Game. Info. leaflet 125: 20 p.

AVERAGE CATCH OF SCALLOPS PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

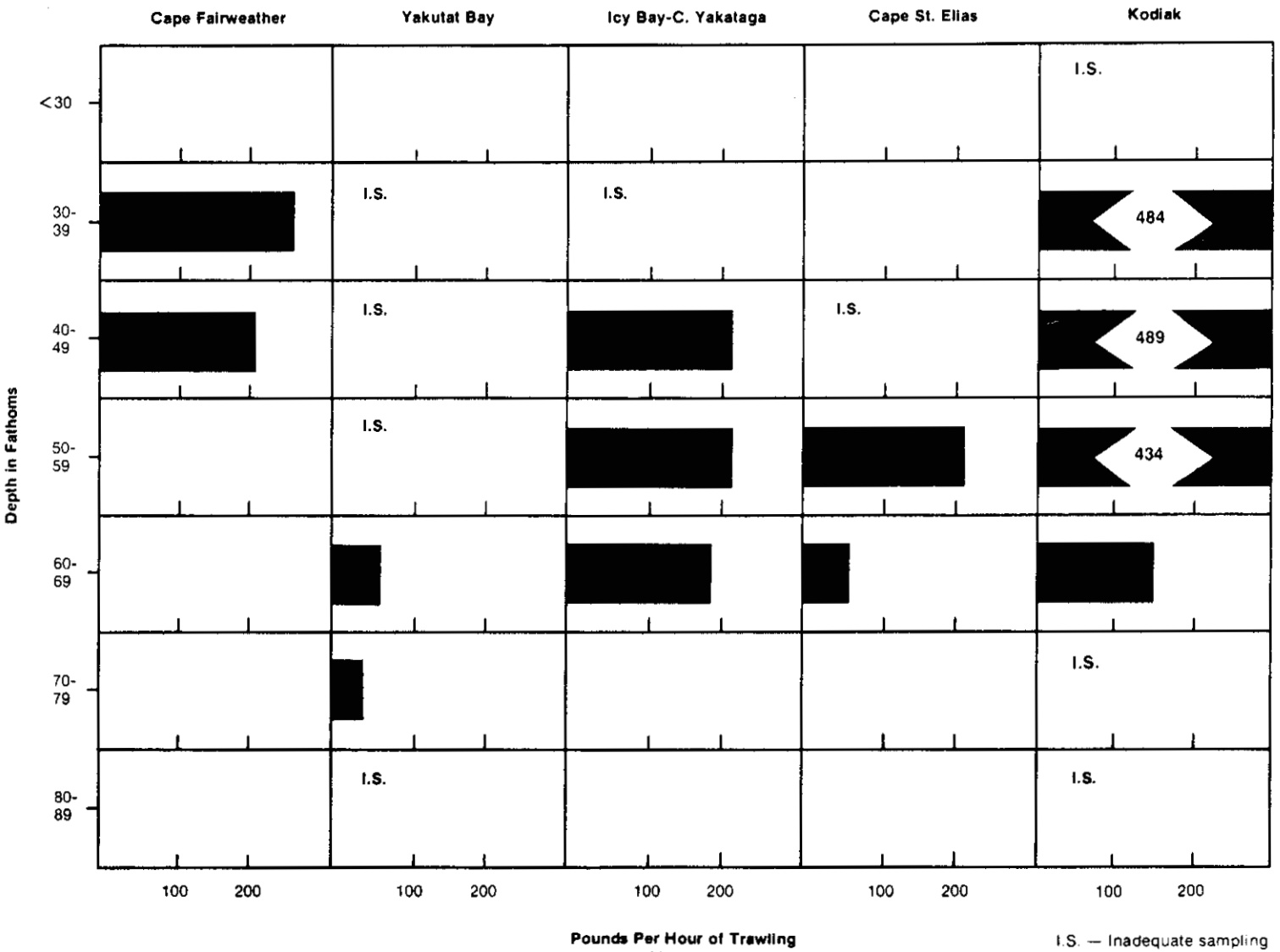


Figure IV-1

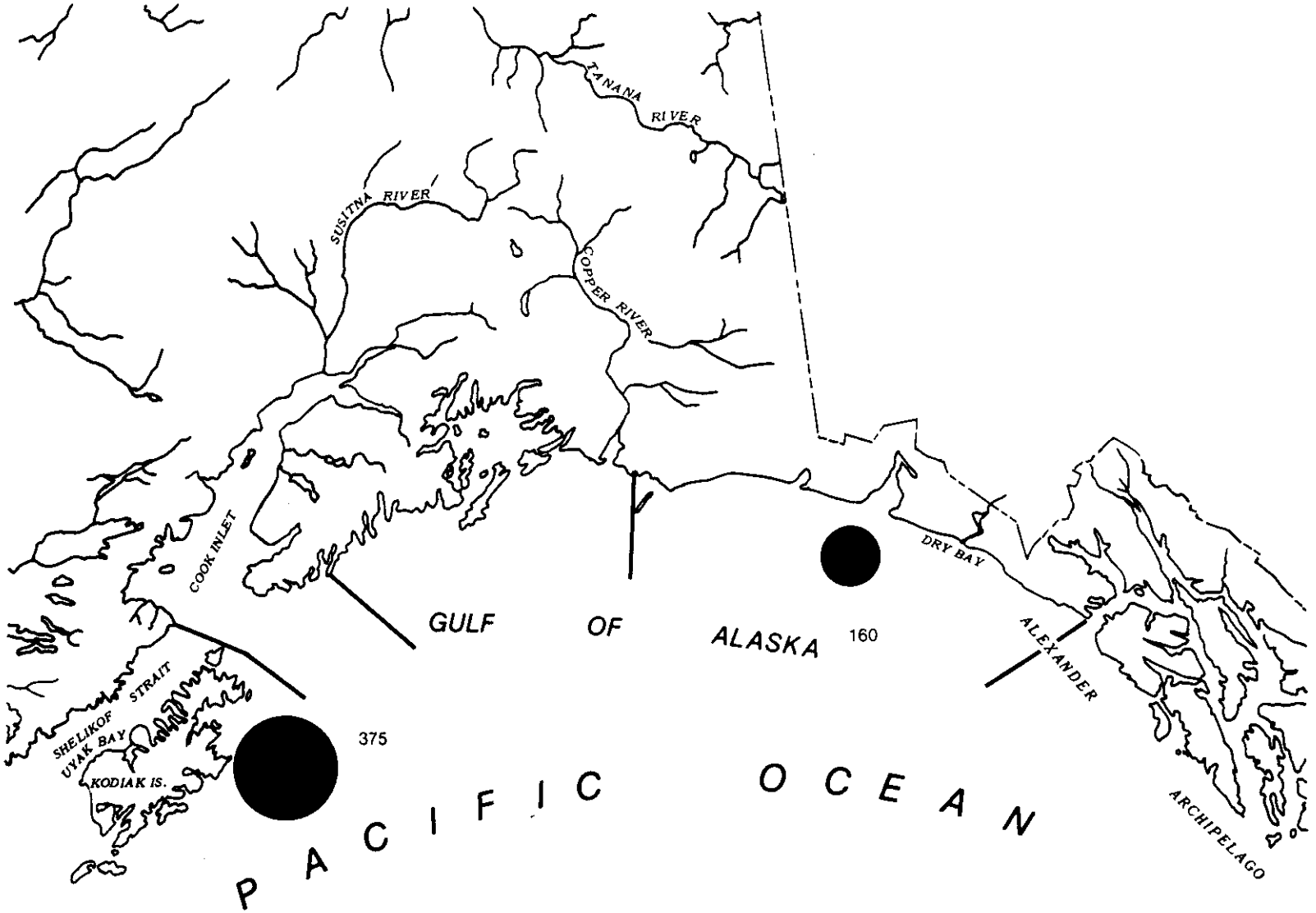
Table IV-3

POUNDS OF SCALLOPS CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

DEPTH FM.	C. FAIRWEATHER			YAKUTAT BAY			ICY BAY TO C. YAKATAGA			C. ST. ELIAS			COOK INLET			KODIAK-SHELIKOF		
	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR
<30	-		-	-		-	-	-	-	-		-	-	-	-	55*	0.5	I.S. [1]
30-39	1,410	5.6	252	25	.3	I.S. [1]	75	.5	I.S.	-		-	-	-	-	2,276*	4.7	484
40-49	422	2.1	201	28	1.0	I.S.	830	4.0	208	108	1.3	I.S.	-	-	-	1,760*	3.6	489
50-59	-	-	-	115	.5	I.S.	415	2.0	208	1,422	6.7	212	-	-	-	1,085*	2.5	434
60-69	-		-	165	2.5	66	395	2.1	188	196	3.5	56	-	-	-	510	3.4	150
70-79	-		-	92	2.5	37	-	-	-	-	-	-	17*	1.0	I.S.	15	0.5	I.S.
80-89	-		-	10	1.1	I.S.	-	-	-	-	-	-	-	-	-			
TOTAL	1,832	7.7		435	7.9		1,715	8.6		1,726	11.5		17	1.0		5,701*	15.2	
Avg. catch/hr. for all depths			238			55			199			150						375

[1] Inadequate sampling

*Includes exploratory drag data for the period 5-31-69 to 7-25-71



Average catch in pounds per hour of trawling by regions for sea scallop based on drags producing 10 pounds or more.

Figure IV-2

FIGURE IV-3

SHELL OIL COMPANY

GULF OF ALASKA

FISHERY RESOURCES

PLOTTED FISHERIES DISTRIBUTION AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING CRUISES", B. A. BOLOTOVA, E. A. ASTRAKHANTSEFF, R. D. PARKS AND C. R. HITZ, N.M.F.S. EXPLORATORY FISHING AND GEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1960-1969.

PREPARED BY ZENAIDA B. MATURGO

DATE: | BY:

SCALLOPS

TRACE TO 200 LBS.

1969 - 1971

TRACE TO >700 LBS./DRAG

Table IV-4

CATCH AND VALUE OF SEA SCALLOPS IN ALASKA
1968-1973
(SOUTHEAST AND KODIAK REGIONS)

Year	1,000 Lbs.	1,000 Dollars
1968	1,734	1,587
1969	1,888	1,542*
1970	1,440	1,420
1971	931	990
1972	1,167	1,400
1973	1,109.4	1,331

* Includes Chignik

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

2. THE CLAM FISHERY

INTRODUCTION

The clam resource of the Gulf of Alaska consists of approximately 160 different species of clams, about 28 of which can be utilized commercially.(21) The fishery is essentially supported by three species, the razor clam (Siliqua patula), the butter clam (Saxidomus giganteus) and the cockle (Clinocardium nuttalli). There appears to be substantial stocks of soft-shell clams (Mya truncata) at Cold Bay and Kachemak Bay and large population of surf clams (Spisula alaskana) occurring subtidally in many areas of central Alaska. However, the importance and size of populations of minor species which may have a commercial potential is largely unknown.(12)

RAZOR CLAM(12)

DISTRIBUTION

The razor clam is distributed from Pismo Beach, California, to the Bering Sea. It occurs in commercial quantities from Tillamook Head, Oregon, to the western end of the Alaska Peninsula. In Alaska, commercial stocks occur on the shores of Cook Inlet, Orcas Inlet, the Copper River delta near Cordova, and the mainland side of Shelikof Strait.(12) (Figure IV-5)(13)

Razor clams are found intertidally to several fathoms in depth on the sandy ocean beaches of the open coast. Fine sand with some glacial silt, as found at Karls Bar located at Orcas Inlet near Cordova, is typical of Alaska clam-producing areas. Near Kodiak, the large beds at Swickshak and Hallo Bay consist of fine sand, volcanic ash and some glacial mud. At Cook

Inlet, razor clams are found in substrata varying from almost entirely coarse white sand (Deep Creek area) to a fine sand-clay-gravel mixture at Clam Gulch.[12]

Razor clams will also be found in the mouths of coastal harbors, but growth is usually inferior in these locations. They are not found in enclosed bodies of waters.

NATURAL HISTORY NOTES

Spawning commences when rising water temperatures reach 13°C., usually in July in Alaska. Spawning takes place over a period of several weeks. Female razor clams may produce six to ten million eggs annually. Fertilization takes place in the open water and the eggs hatch into larvae within a few hours to a few days following fertilization; development depends on water temperature. The larvae exist as free-swimming veligers for five to sixteen weeks. After the veliger stage, the young clams develop a shell and settle to the bottom where they "set" into the top layer of sand. In years of heavy setting, as many as 1,000 to 1,500 young clams per square foot of beach are found. However, because of their delicate structure, high mortalities are common at this stage.

Juvenile clams grow slowly through the fall and winter months. Growth accelerates during the spring with warming waters and increased food supply and continues at a rapid rate through the summer. The growth rate of razor clams varies with locality. In Alaska, initial growth rate is slower than in the northwest states.

FISHERY INFORMATION

Razor clams reach a harvestable length of 100 mm (approximately four inches) in to or more years in the northwest states. The razor clams of the Swikshak and Cordova beaches do not reach a harvestable length until their

fifth and sixth years, respectively. However, Cook Inlet clams appear to grow much faster, reaching harvestable length in their third year. In Alaska, ages of clams up to 19 years have been recorded.

Razor clams are harvested only from certified beaches because of paralytic shellfish poison (PSP). The principal clamming areas are located on Kodiak Island, the Cordova region and Cook Inlet. The recent harvest trend indicates that razor clam production has been slowly declining since 1960 to an all-time low of 38,916 pounds in 1969 (Table IV-5), recovering substantially in 1970. The reasons for the decline are not known. However, several reasons may be responsible: (1) overfishing of the known and accessible clam stock; (2) lack of marketing resources coupled with increasing operational costs to the processor; and (3) the education of the general public to the PSP problem in Alaska.[12]

BUTTER CLAM[12]

DISTRIBUTION

This species occurs from Humboldt Bay, California, northward to the Aleutian Islands. Butter clams are found on the lower levels of the intertidal zone out to depths of about 30 feet, usually on well-protected beaches. Butter clams are primarily found in a mixed gravel-sand-mud substraturm although they occasionally occur in sand bottoms. They are found within the upper 12 inches of the substratum.

NATURAL HISTORY NOTES

Sexes are separate, and spawning occurs at about 20°C. Fertilization is accomplished externally. After hatching, the larvae are free-swimming for

20 to 30 days after which time the larvae metamorphose into set clams and settle to the substratum.

Progressive growth is extremely slow in Alaskan waters. Butter clams take from 15 to 20 years to reach a diameter of 2-1/2 inches or commercial size.

Spawning is largely regulated by warming temperatures. Successful spawning and setting of butter clams is at best sporadic in the cool Alaskan waters. For example, certain British Columbia butter clam beds have had only one major spawning and setting in 20 years. The inability to reproduce has been attributed to low temperatures.

FISHERY INFORMATION

The butter clam industry began in 1930 in southeastern Alaska with a catch of 25,000 pounds worth about $720 to the fishermen. During the period 1942-1946, the industry grew to significant importance in Alaska. Expansion was primarily due to the wartime demand for shellfish products. During this period, the butter clam fishery of central Alaska was conducted at a relatively low level (Table 1).

During the 1945-1946 season, regulatory action brought about by the presence of paralytic shellfish toxin in the product curtailed the industry. The industry has never recovered from the legal action and essentially died in central Alaska after 1955.[12]

COCKLE[12]

DISTRIBUTION

This species occurs from San Diego to the Bering Sea. It is most common in British Columbia and in Puget Sound, Washington waters.

Cockles are found in both intertidal and deep water, one to three inches beneath the surface of the bottom and are often only partially buried. They appear to prefer a substratum of mixed sand and mud and are commonly found on eel-grass flats.

NATURAL HISTORY NOTES

The cockle differs from the razor and butter clams in that it is hermaphroditic, i.e., individuals produce both sperm and eggs. Spawning commence in the summer and continues for some time. Fertilization is external in the surrounding waters. The larvae are free swimming. After a period, they set into the substratum where they occupy a semi-permanent space.

COCKLE FISHERY

The south-central coast of Alaska formerly was the chief source in the United States of these clams. Because cockles and butter clams often occurred in the same vicinity, they were harvested jointly in the commercial catch. The major fishery for cockles was located on Kodiak Island and in the Cordova region.

During the period 1943-1962, significant fluctuations occurred in cockle landings. Commercial landings peaked in 1960 with a catch of about 1.3 million pounds whole weight with a value of $165,138 to the fishermen. Landings abruptly fell off in the 1961-1962 seasons, and the fishery has become essentially nonexistent since that time.

CLAM FISHERY STATUS AND FUTURE OUTLOOK

The clam industry is on a downward trend. Since 1961, the industry has been primarily dependent on razor clams. Landings of razor clams have been reduced in recent years. The decline in landings is not only indicative of overfishing, but, also, reflects the paralytic shellfish poisoning (PSP) problem. As a result, commercial clam digging occurs only on certified beaches in the Kodiak, Cordova and Cook Inlet areas. At present, razor clams are the only species being commercially harvested and processed by the industry. This is probably because razor clams eliminate the toxin rapidly. Most of the toxin is eliminated by removal or cleaning of the stomach which is standard practice in razor clam operations.

The fate of the clam industry largely depends on the development of economically feasible methods to detoxify clams. Depuration of the toxin through holding in "clean" waters seems to be the most promising method.[12]

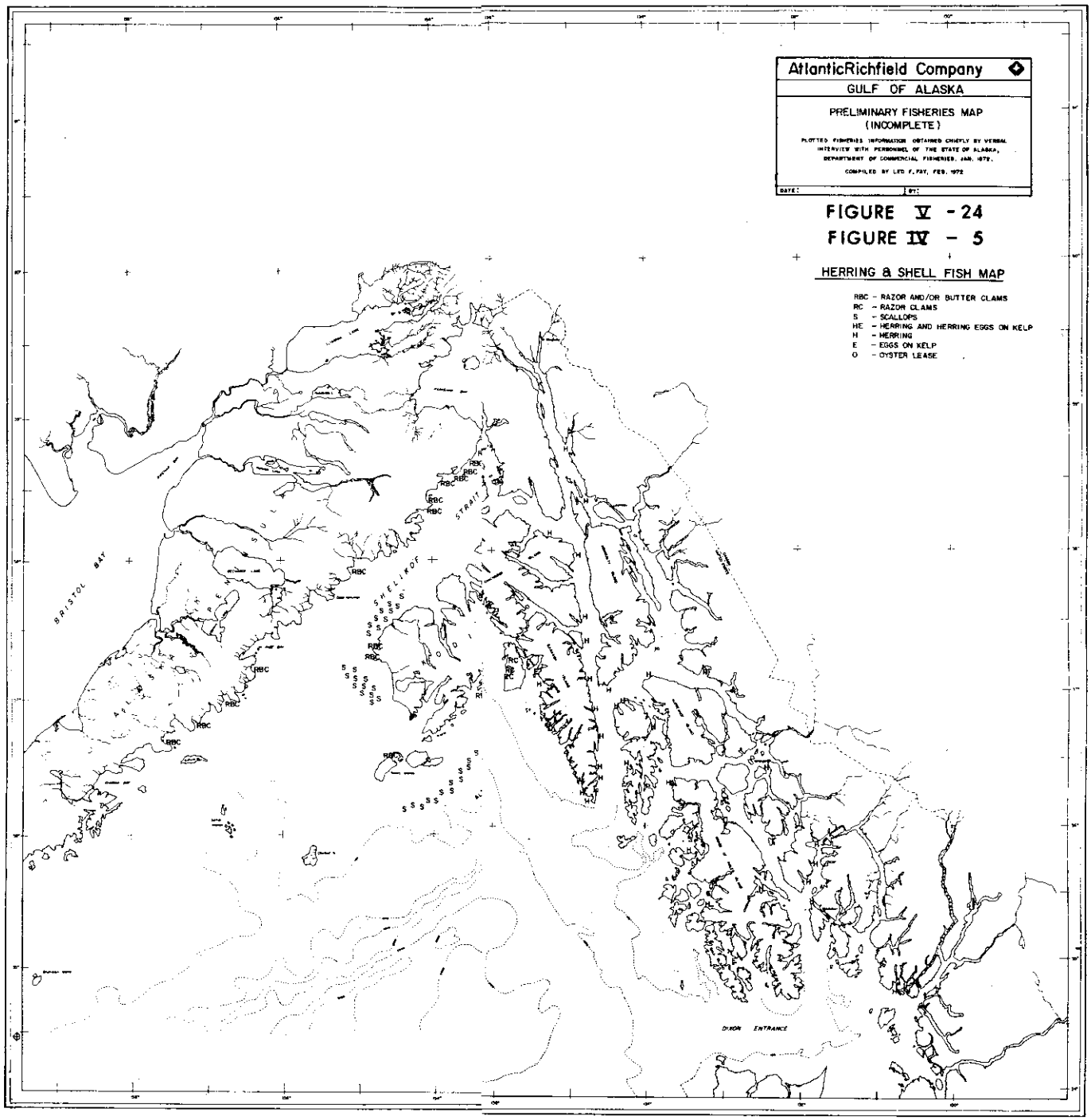

AtlanticRichfield Company
GULF OF ALASKA
PRELIMINARY FISHERIES MAP
(INCOMPLETE)
PLOTTED FISHERIES INFORMATION OBTAINED CHIEFLY BY VERBAL INTERVIEW WITH PERSONNEL OF THE STATE OF ALASKA, DEPARTMENT OF COMMERCIAL FISHERIES, JAN. 1972.
COMPILED BY LEO F. FAY, FEB. 1972
DATE:
BY:
FIGURE V - 24
FIGURE IV - 5
HERRING & SHELL FISH MAP
RBC - RAZOR AND/OR BUTTER CLAMS
RC - RAZOR CLAMS
S - SCALLOPS
HE - HERRING AND HERRING EGGS ON KELP
H - HERRING
E - EGGS ON KELP
O - OYSTER LEASE
BRISTOL BAY
SHELIKOF STRAIT
DIXON ENTRANCE

Table IV-5

RAZOR CLAM HARVEST IN CENTRAL ALASKA
1927-1973
Thousands of Pounds & Thousands of Dollars

Year	Quantity	Value
1927	222	29
1928	128	21
1929	246	41
1930	299	48
1931	366	61
1932	614	89
1933	365	49
1934	273	38
1935	300	38
1936	273	40
1937	281	47
1938	275	39
1939	296	48
1940	349	73
1941	179	47
1942	391	70
1943	642	124
1944	576	111
1945	597	115
1946	632	162
1947	212	58
1948	428	128
1949	595	204
1950	771	264
1951	824	348
1952	445	165
1953	520	193
1954	430	160
1955	689	256
1956	508	189
1957	543	202
1958	232	86
1959	394	131
1960	445	165
1961	324	120
1962	240	79
1963	144	52
1964	42	20
1965	89	40
1966	29	9
1967	60	30
1968	79	20
1969	86	13
1970	160	40
1971	243	70
1972	214	68
1973	231	89

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

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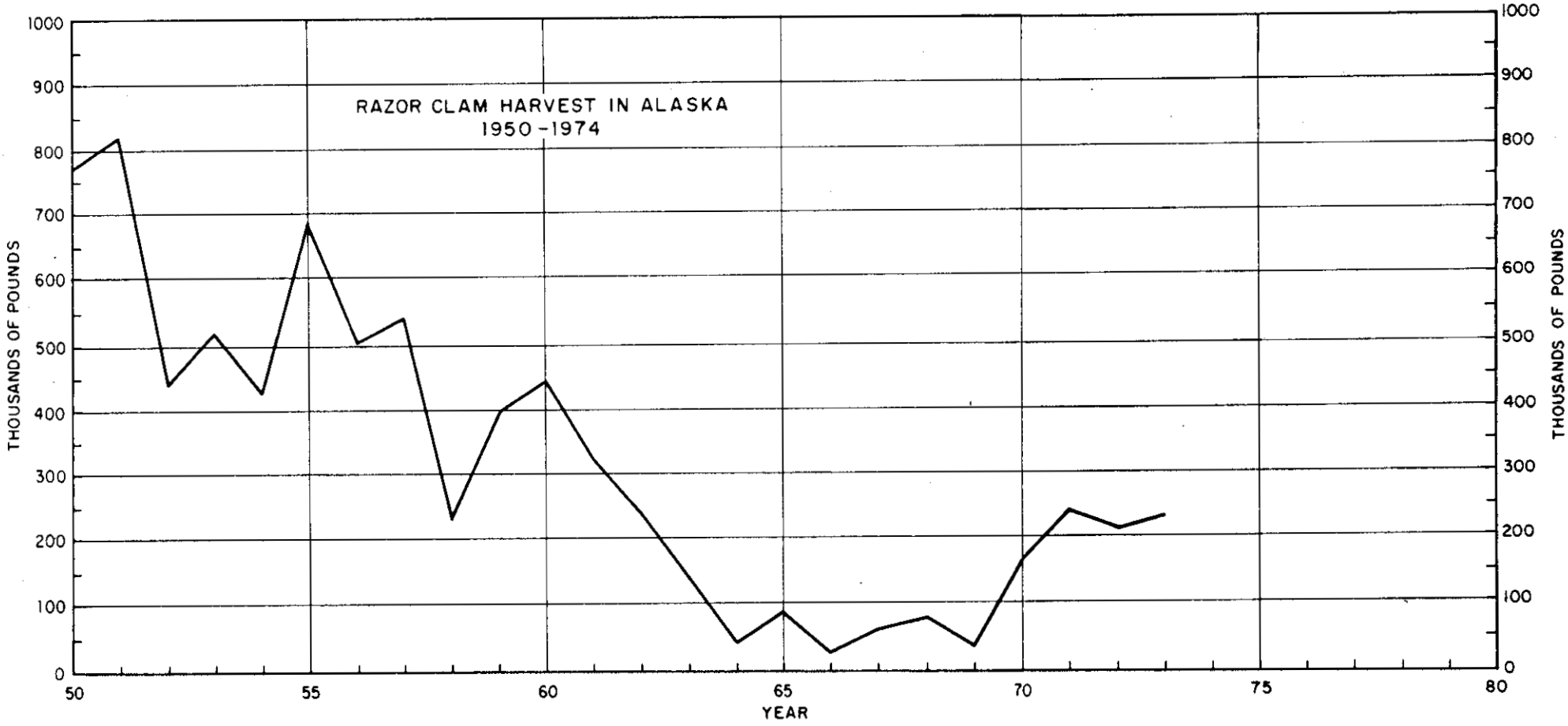

RAZOR CLAM HARVEST IN ALASKA
1950 - 1974
THOUSANDS OF POUNDS
1000
900
800
700
600
500
400
300
200
100
0
50
55
60
65
70
75
80
YEAR

Figure IV-4

3. THE ABALONE FISHERY

DISTRIBUTION

The Alaskan Abalone, or pinto abalone, Haliotis kamtschatkana, is abundant along the outside coastal waters of Southeastern Alaska from Dixon Entrance to Icy Straits. However, fishermen have reported that it may also be found west from Cape Spencer to the sand beaches of the Yakutat area.(14)

NATURAL HISTORY NOTES

Abalones are marine snails belonging to the genus Haliotis, family Haliotidae, and are related to clams, oysters, mussels and squids. The Alaskan abalone is one of the smallest species of abalone. It grows to six inches in length, but is rarely found longer than five and a half inches.

The Alaskan abalone apparently requires the influence of deep ocean swells. They do not occur far from the outside coast, and are found in thick kelp beds and in rock cracks and crevices where waves cannot easily dislodge them. On more exposed islands and rocks, they are generally found on the lee side. In deeper water they occur in exposed areas in boulder patches near kelp beds and sandy bottoms. Although abalone can be hand picked during extreme low tides they are most common from low-low water to depths of 30 to 40 feet.

Marine algae, from minute forms to giant kelp, are the principle food of abalone.

ABALONE FISHERY

Alaskan coastal natives have long used abalone as a supplemental food. The subsistence use of abalone continues and there has been considerable interest in developing a commercial fishery. Each year the Alaska Department of Fish and Game issues permits to fishermen who would like to develop a commercial abalone fishery. However, in nearly all experiences, fishermen using scuba gear have found only meager profits. The recovery of abalone meat is small for the expense and effort involved.

Abalone landings in Alaska for the period 1964 to 1973 are shown in Table IV-6.

Table IV-6
ABALONE LANDINGS IN ALASKA
1964-1973
Thousands of Pounds & Thousands of Dollars

Year	Quantity	Value
1964	1	1
1965	-	-
1966	5	5
1967	4	6
1968	-	-*
1969	-	-*
1970	-	-
1971	1	2
1972	2.6	2.6
1973	3.0	3.1

*No Production 1968 and 1969

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

V. THE FISH RESOURCES

1. THE GROUNDFISH RESOURCES

INTRODUCTION

Virtually all groundfish exploitation has been carried on by the large fleets from the Soviet Union and Japan. The main species in the Gulf of Alaska groundfish catch, which has averaged over 200,000 metric tons annually, is Pacific ocean perch. Exploratory trawl sampling described by Alverson et al[15] indicated that ocean perch made up from sixty-two to ninety-eight percent of the total rockfish catch at sampling stations throughout the northeast Pacific.

Russian data give no indication of other species in their Gulf of Alaska groundfish catch. However, it can be assumed to be similar to Japanese trawl catches in the region. These show that blackcod (sablefish) and Alaska pollock are the second most abundant species, together comprising about fourteen percent of the catch. However, the main abundance of pollock appears to be in the Shumigan area of the Aleutian chain. Blackcod appears to be more uniformly distributed throughout the Gulf, and also makes up greater than ninety percent of Japanese longline catches which, in 1968, made up thirteen percent of the total Japanese groundfish catch in the Gulf of Alaska.

During the past several decades, the National Marine Fisheries Service, formerly the Bureau of Commercial Fisheries, and the International Pacific Halibut Commission have conducted extensive fish and shellfish surveys in waters overlying the continental shelf and slope in the Northeastern Pacific Ocean.[16,17] During these surveys, fish and shellfish populations were sampled with otter trawls, shrimp trawls and beam trawls. These exploratory trawls provide an excellent source to determine the type, distribution, and densities of

demersal fish and shellfish species that inhabit these waters, especially in areas where no commercial fishing was conducted.

NATIONAL MARINE FISHERIES SERVICE (BCF) EXPLORATORY TRAWLS

Data used in this report were taken from 2,463 exploratory drags conducted by the National Marine Fisheries Service starting in 1950 and ending in 1968 in the offshore and inside waters around the Gulf of Alaska; and from 432 drags conducted from May 3, 1969 to July 25, 1971.[5] To facilitate analysis of the data, the Gulf of Alaska area was divided into five regions, namely: 1) Southeastern Alaska - from Dixon Entrance to Cape Spencer including the inside waters; 2) Yakutat region - from Cape Spencer to Cape St. Elias; 3) Prince William Sound region - from west of Cape St. Elias to Pye Island; 4) Cook Inlet; and 5) Kodiak-Shelikof region, which covers all parts around Shelikof Straight up to west end of Kodiak Island.

For the 1969-1971 exploratory drags, the relative abundance of catch for all species in the three Gulf regions and depth zones followed the same trend as the 1950-1968 drags except for scallops.

The data were analyzed to determine the average catch per unit of successful trawling of a particular species or groups of species by regions and by depth intervals. A 50-fathom depth interval was used for the continental shelf (1-99 fathoms) and upper continental slope (100-199 fathoms). Beyond the

200-fathom contour, 100-fathom intervals were chosen to evaluate distribution and abundance patterns in deeper waters.

Catches from successful sampling stations were evaluated by major fish groups for the demersal fish species, except halibut and sablefish which were analyzed separately. Trace (10 lbs.) catches were excluded from the analysis; however, the location of drags taking each haul was determined as the median between the deepest and shallowest depths recorded for each exploratory drag. The total mines trawled for the specific depth interval was determined and converted to hours to establish standard units of fishing time. Average catches are computed per hour of successful trawling.(5)

On areas of multiple depth zone sampling, the highes average catch per hour of trawling for demersal fish species occurred in the outer shelf (50-99 fathoms) and inner slope (100-149 fathoms). Alverson (1968)(18) signified that the greatest density of demersal fishes in the Gulf of Alaska region occurred on the continental slope rather than on the continental shelf. This is especially true among the rockfishes, sablefish, and some flounder species. Most demersal fishes concentrate in the deeper portion of their vertical depth range during the winter months and move to shallower depths during spring and summer.

RESULTS OF EXPLORATORY TRAWLS - INTERNATIONAL PACIFIC HALIBUT COMMISSION

In addition to exploratory fishing in the Gulf of Alaska by the Bureau of Commercial Fisheries and its' successor agency, National Marine Fisheries Service, the International Pacific Halibut Commission (IPHC)

also conducted trawl surveys in those waters from 1961 to 1963.[16] The IPHC data will prove useful in evaluating potential new fisheries, and should furnish indices of abundance which can be compared with more recent surveys, thus providing an indication of change in the status of the fishery resources during the past decade. The IPHC survey was conducted between Cape Spencer and Unimak Island, Alaska; 1,272 hauls were completed with a bottom trawl which was commonly used by Pacific coast fishermen.[6]

Seasonal changes in the abundance of commercially important (or potentially valuable) groundfish were examined for four areas within the Gulf of Alaska and for five depth zones. Results indicated that commercially valuable groundfish were more abundant in the Peninsula and Kodiak areas than in the Kenai or Yakutat areas. The greatest availability of valuable groundfish was during the summer and fall seasons when most fish occurred within the shallower portion of their range, particularly in waters south of Unimak Island, east and south of Afognak Island, and several areas south and west of Kodiak Island.

Flounders dominated the groundfish catch both in abundance and in numbers of valuable species. The Gulf-wide average catch rate of flounders was 382 pounds per hour trawled compared with 182 pounds for roundfish, and 63 pounds for rockfish. The average catch rate of king and snow crab combined was 368 pounds per hour trawled.

Arrowtooth flounder (turbot) was the most abundant groundfish throughout the Gulf. This species occurred in all depth zones and in all the areas surveyed but was most abundant in the western Gulf at depths greater than 99 fathoms. Average catch rates reached 2,500 pounds per hour trawled at depths of 200-260 fathoms in the Kodiak area during the spring.

Flathead sole ranked second in flounder abundance and third in groundfish abundance. Their distribution was fairly uniform throughout the Gulf and they were generally most abundant between 100 and 199 fathoms. Abundance was notably lower in the winter.

Pacific halibut ranked third in flounder abundance, particularly in the Kodiak and Peninsula regions. Highest catch rates in all regions occurred during the spring and summer at depth of 1049 fathoms, and declined during fall and winter when halibut moved into deeper waters.

Gulf-wide abundance of rock sole was fourth in the flounder group and seventh in the groundfish community. This species was the dominant flounder in the western Gulf at shallow depths. Highest densities occurred during the summer and fall in the Kodiak area at depths of 1-49 fathoms.

Rex and Dover sole ranked fifth and sixth in flounder abundance. Highest catch rates of rex sole occurred in the Kodiak area during the spring at depths of 100-199 fathoms. Dover sole catch rates were highest in the Kodiak and Kenai areas during the spring and summer at the greatest depths sampled. It appears that a substantial part of the Dover sole resource in the Gulf probably occurs in waters deeper than those included in the survey.

The walleye (Pacific) pollock catch rate was the second highest among the roundfish and fifth highest among all the groundfish. Pollock was widely distributed throughout the Gulf but was most abundant in the Kodiak and Peninsula areas where highest catch rates occurred during the summer and fall at depths of 100-199 fathoms. Results of recent NMFS surveys indicate that the pollock abundance throughout the Gulf may be considerably higher now than when the IPHC survey occurred.

Pacific cod ranked third in roundfish abundance and eighth in groundfish abundance on a Gulf-wide basis. Its geographic distribution was similar to that of pollock except that cod occupied a wider range of depths. Highest average catch rates usually occurred at depths less than 100 fathoms during the spring and summer or greater than 99 fathoms during the fall and winter.

Sablefish (blackcod) ranked fifth in Gulf-wide abundance of roundfish and eleventh in groundfish abundance. Although sablefish are present throughout the Gulf, they were most abundant in the Peninsula and Kodiak regions. This species is also a deepwater form and therefore was not adequately covered by the survey. Highest average catch rates were at depths of 200-260 fathoms during the spring in the Kodiak area and at 150-199 fathoms during the summer in the Peninsula area.

ROCKFISH

DESCRIPTION AND ABUNDANCE

Rockfish populations in all regions are underestimated since these groups are known to be distributed both on the ocean obttom and at considerable distances above it. The rockfish group was represented by a greater number of species than any other fish group sampled in Bureau of Commercial Fisheries (National Marine Fisheries Service) exploratory trawls from 1950-1968.(5) About 20 rockfish species, mostly from the genus Sebastodes were identified in the Gulf. Two species of the genus Sebastolobus, both of which are deep-water inhabitants contributed much to the rockfish catches beyond 99 fathoms. Many of the Sebastodes species appear to be primary pelagic forms and large catches of rockfishes were reported taken in midwater trawls. For this reason, these species had the greatest bathymetric range, occurring in all depth zones sampled.(5)

RESULTS OF EXPLORATORY TRAWLS - NATIONAL MARINE FISHERIES SERVICE

Generally, the average catch of rockfish per hour of exploratory trawling increased with depth until it reached its maximum in the 100 to 149-fathom depth zone (Table V-1 and Figure V-1). Rockfishes were mostly encountered in the offshore waters of all regions; rarely were they found in the inside waters in southeastern Alaska. Furthermore, the number of species caught decreased in the inside waters. Pacific ocean perch, the most important single species of rockfish dominated the catches on the outer continental shelf and upper slope (50-149 fathoms) in the Gulf of Alaska. It was the principal species caught in all regions and in almost all depth zones samples, and was second to turbot as the most abundant species caught in the

AVERAGE CATCH OF ROCKFISH PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

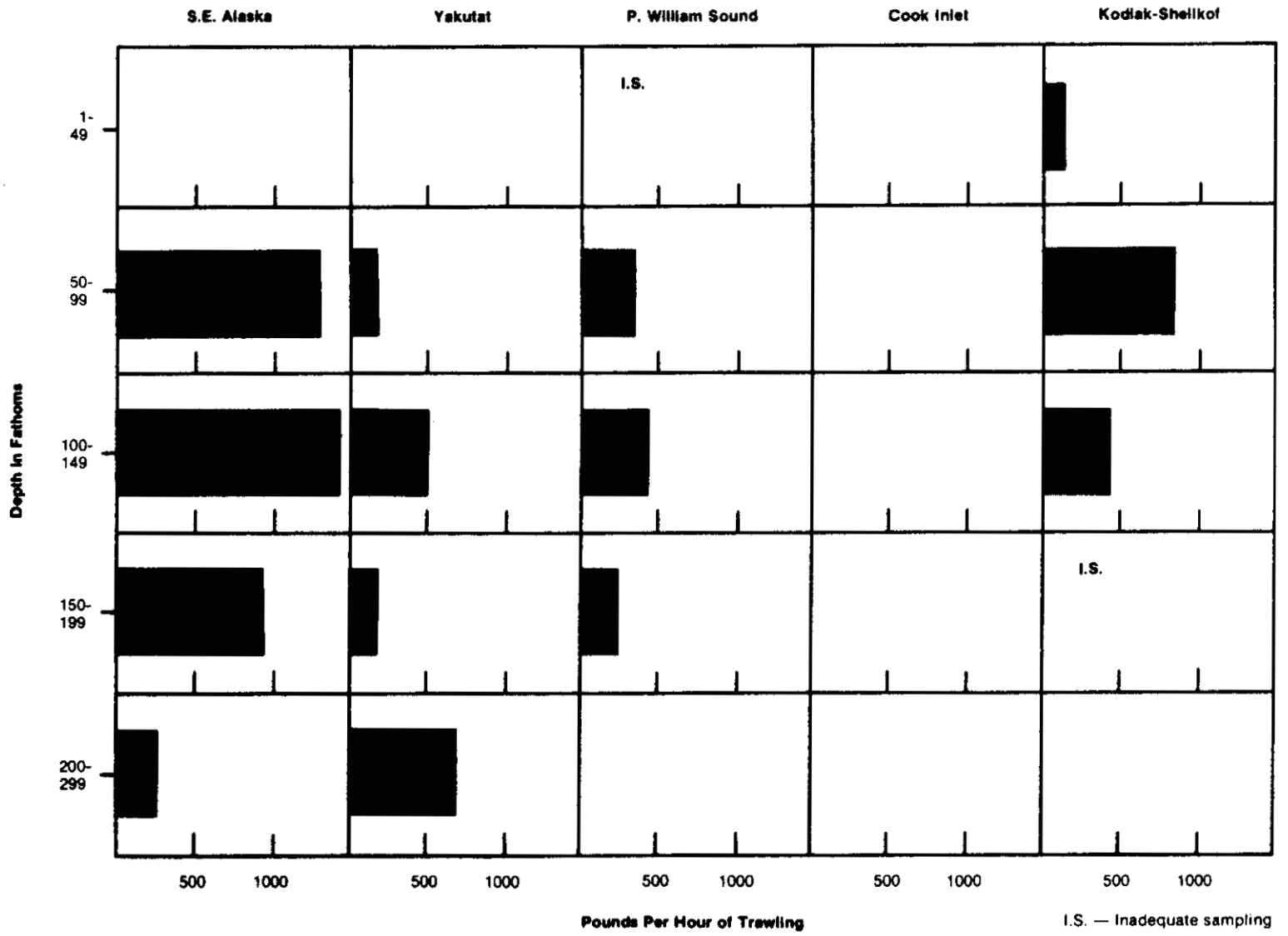


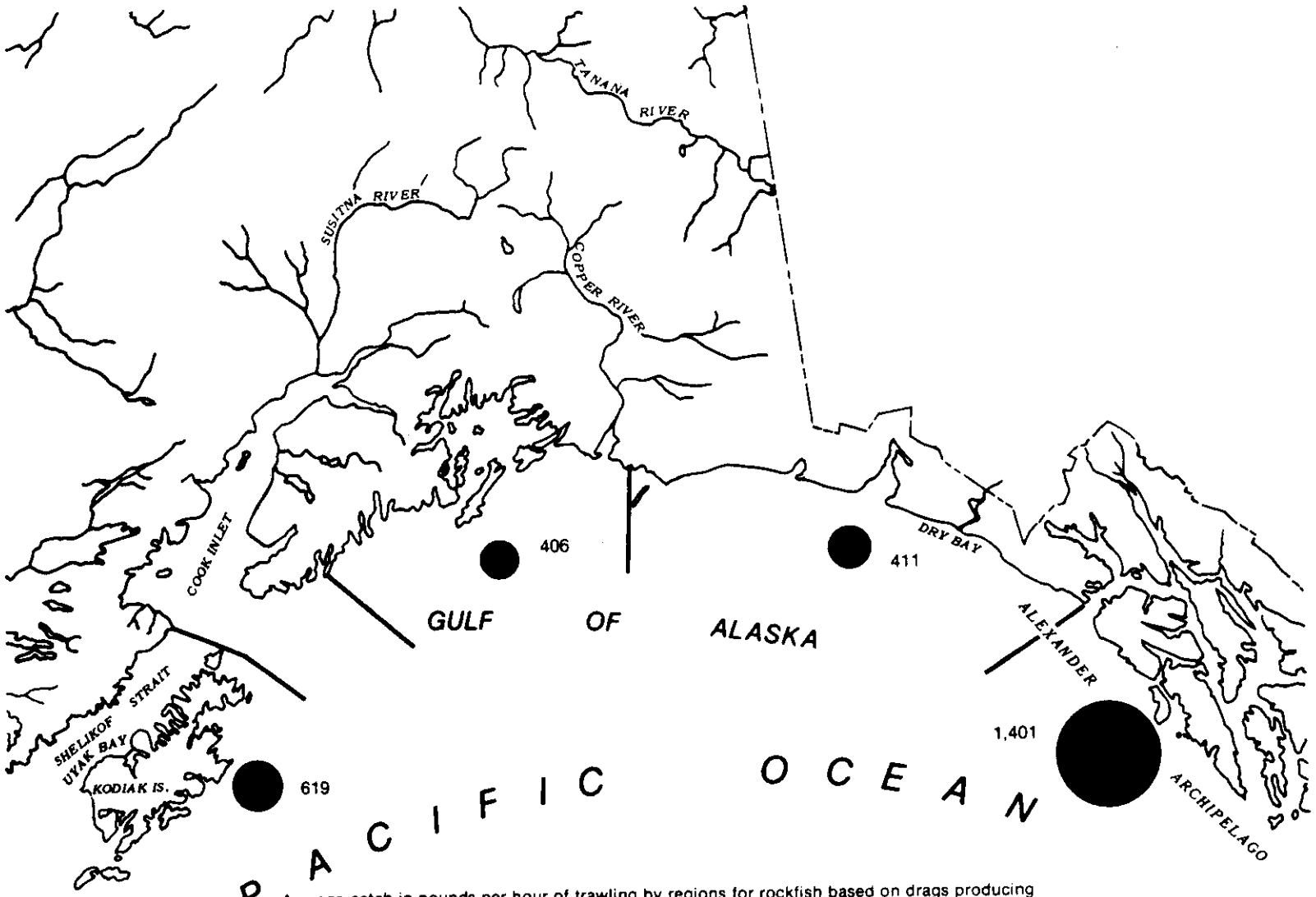
Figure V-1

Table V-1

POUNDS OF ROCKFISH CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

DEPTH FM.	S. E. ALASKA			YAKUTAT			P. W. SOUND			COOK INLET			KODIAK-SHELIKOF		
	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR
1-49	-	-	-	-	-	-	65	1.0	I.S.[1]	-	-	-	240	2.0	120
50-99	30,923	23.5	1,316	3,090	16.5	187	21,236	58.1	366	-	-	-	23,184*	29.9	775
100-149	142,363	94.2	1,511	14,231	25.8	552	27,668	59.3	466	-	-	-	6,243	15.5	403
150-199	14,100	14.4	979	1,072	5.0	215	1,560	6.0	260	-	-	-	300	1.0	I.S.
200-299	500	2.0	250	2,315	3.1	747	-	-	-	-	-	-	-	-	-
300-399	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	187,886	134.1		20,708	5.04		50,529	124.4					29,967*	48.4	
Avg. catch/hr. for all depths			1,401			411			406			-			619

1/Inadequate sampling
*Includes exploratory drag data for the period 5-31-69 to 7-25-71.



Average catch in pounds per hour of trawling by regions for rockfish based on drags producing 10 pounds or more.

Figure V-2

FIGURE V-3

SHELL OIL COMPANY

GULF OF ALASKA

FISHERY RESOURCES

PLOTTED FISHERIES DISTRIBUTION AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING DRAGS", R. J. WOLOTIRA, S. A. ASTRAKHANTSEFF, R. S. PARKS AND C. R. HITZ, N.M.F.S. EXPLORATORY FISHING AND GEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1950-1968.

PREPARED BY ZENAIDA D. MATURGO

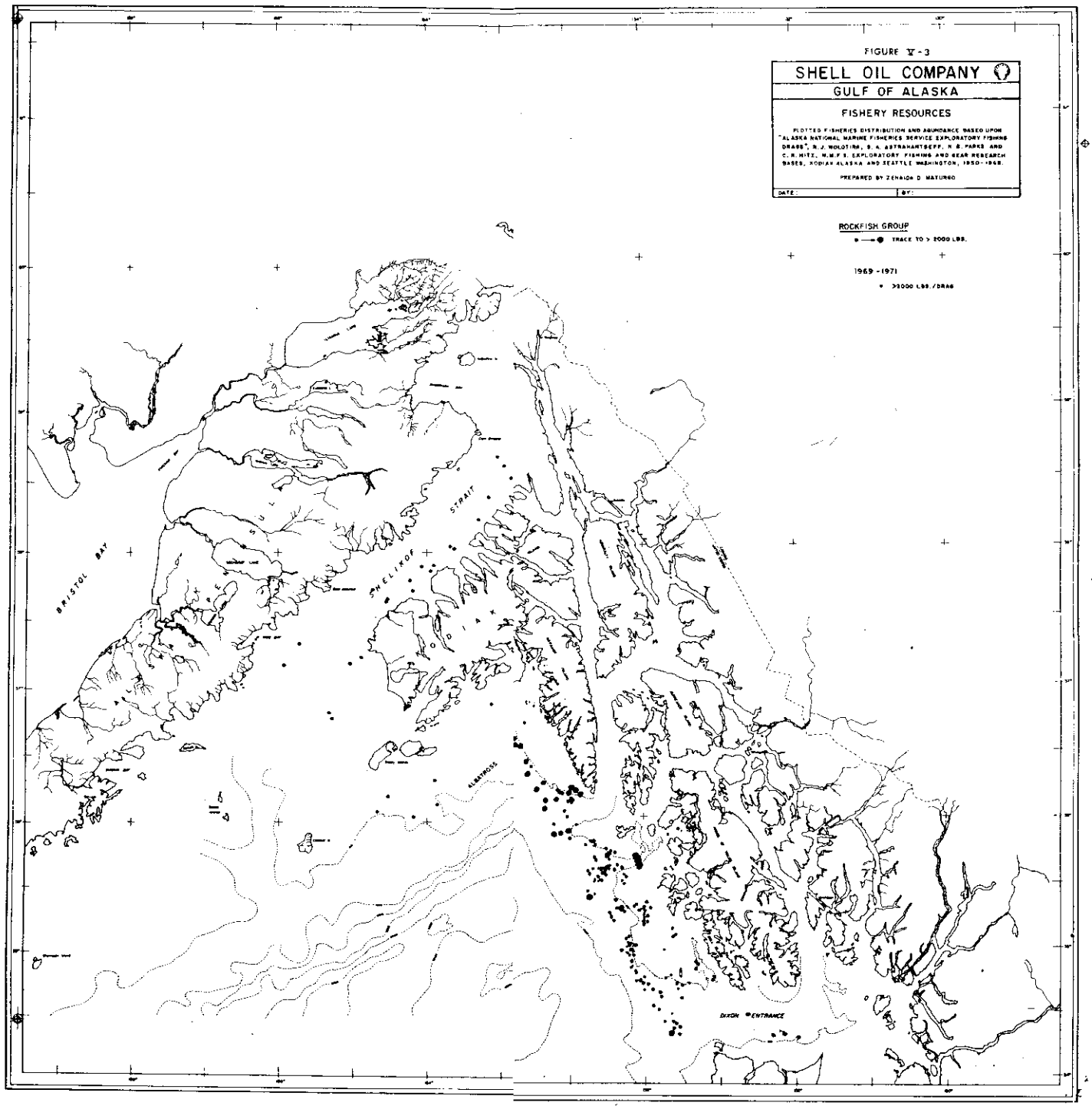
DATE: | BY:

ROCKFISH GROUP

TRACE TO > 2000 LBS.

1969 - 1971

>2000 LBS./DRAG



Gulf of Alaska area (Table V-2). It accounted for over 62 percent of the entire rockfish catches at depths up to 199 fathoms. The largest catch rates of rockfish in Bureau of Commercial Fisheries trawls occurred in southeastern Alaska in the 100-149 fathom depth interval (Figure V-2). Pacific ocean perch made up approximately 74 percent of the southeastern Alaska rockfish catch.(5) The Gulf-wide distribution of rockfish is shown in Figure V-3.

Table V-2

Ten most frequently encountered and most abundant demersal fish species in the Gulf of Alaska.

	Frequently Encountered		Most Abundant
1.	Arrowtooth flounder or turbot	1.	Arrowtooth flounder
2.	Pacific halibut	2.	Pacific ocean perch
3.	Flathead sole	3.	Flathead sole
4.	Pacific cod	4.	Walleye pollack
5.	Walleye pollack	5.	Rock sole
6.	Pacific ocean perch	6.	Pacific cod
7.	Rex sole	7.	Dover sole
8.	Sablefish	8.	Sablefish
9.	Skate	9.	Pacific halibut
10.	Rock sole	10.	Starry flounder(15)

PACIFIC OCEAN PERCH

INTRODUCTION

Pacific Ocean perch are distributed along the continental shelf and slope areas from La Jolla, California, to the Kurile Islands in the northwest Pacific, as well as in the continental slope regions of the Bering Sea. Ocean perch are commonly found near or somewhat off the bottom in depths from 75 to 230 fathoms, and are usually around the 90-fathom contour. Common habitats of this species are the gullies, canyons and other submarine depressions of the upper continental slope.(19)

NATURAL HISTORY NOTES

The movement of ocean perch in the Gulf of Alaska occurs from May to September, principally in the Unimak Pass area of the eastern Aleutians. At this time, schools of fish are in depths mostly between 75 go 100 fathoms. Feeding ceases during mating, after which the fish school by sex. Most of these schools migrate into the northern and northeastern Gulf, females going as far as the Yakutat area. Some concentrations of females remain in the Unimak Pass region. While in the northern Gulf of Alaska, schools of mature females are found in depths of from 120 to 225 fathoms.(19)

Research on the distribution of ocean perch larvae in the Gulf of Alaska indicates that the northern Gulf is an important spawning area.(19) The densities and abundance of ocean perch larvae are highest in the Yakutat area, the Kodiak Island area ranking second in abundance. Lesser densities were found in the Shumigan and Unimak Island areas. Ocean perch larvae appear in late April and May over the entire Gulf of Alaska in waters over bottom depths of 90 to 350 fathoms. Larvae have been found over continental shelf and

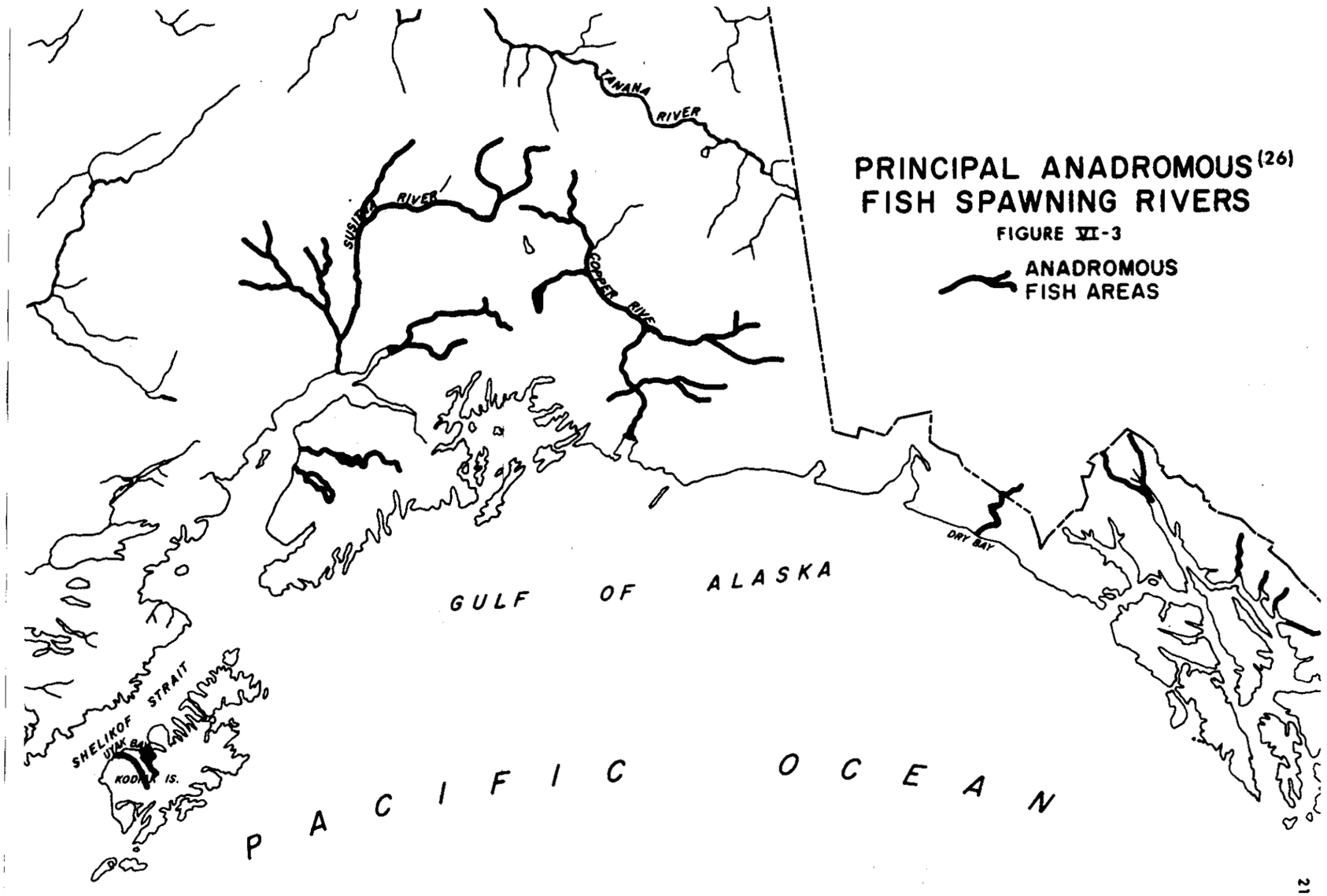
slope areas as far as eighty to one hundred miles from shore, and continue to be found until early June in the western Gulf and as late as mid-July in the eastern part of the region.(16)

During their first year, ocean perch lead a pelagic existence, at which time their distribution is largely determined by water currents. During their second year, young ocean perch take up a bottom habitat. They remain in water from 65 to 75 fathoms until they become sexually mature. Large numbers of ocean perch in the length range of 20 to 30 mm have been found in the stomachs of albacore, Thunnus alalunga, caught more than one hundred miles off the Oregon and Washington coasts. This and observations of young ocean perch "balling on the surface" have led to the conclusion that the first year of life is spent in the surface waters.

They later move to the bottom in shallower depths, rarely greater than 125 fathoms.(19)

The identification of small ocean perch relative to other rockfish species in open to some question. However, the dominance of Pacific ocean perch in the rockfish catch of the Gulf of Alaska makes the occurrence of larval ocean perch highly probable in this area.

Juvenile fish in the pelagic habitat feed mainly on planktonic crustaceans, and benthic juveniles eat euphausiids and pandalids. One report gives a breakdown for ocean perch (presumably the larger fish) as seventy-five percent crustaceans, fifteen percent squid and six to seven percent fish.(19)


PRINCIPAL ANADROMOUS[26]
FISH SPAWNING RIVERS
FIGURE XI-3
ANADROMOUS
FISH AREAS
TANANA RIVER
SUSITNA RIVER
COPPER RIVER
DRY BAY
GULF OF ALASKA
SHELIKOF STRAIT
UYAK BAY
KODIAK IS.
PACIFIC OCEAN

FISHERY INFORMATION

In the Gulf of Alaska, the center of abundance of Pacific ocean perch appears to be in regions from Kodiak west to the Atka area, although the distribution of highest densities is likely to change through the seasons as a result of spawning movements. According to Japanese catch statistics, the abundance of ocean perch was highest in the region between Kodiak and the eastern Aleutians. Catch rates are somewhat higher in the western Gulf than in the Yakutat and southeastern areas. However, catch rates throughout the Gulf are generally higher than those in the Charlotte and Vancouver areas. (15) Alverson et al. (1964) found catch rates for ocean perch during experimental hauls higher in the British Columbia-southeastern Alaska area than in the Gulf.

Pacific Ocean perch dominated the rockfish catch in IPHC Trawls (1961-1963) in the Gulf. Geographically, rockfish were most abundant in the Kodiak and Peninsula regions as related to Kenai and Yakutat. In all regions surveyed, highest levels of abundance were obtained at depths of 150-199 fathoms. Average catch rates exceeded 1,000 pounds per hour trawled in the Peninsula and Kodiak regions during the winter. Such rockfish catches represented 36% and 46% of total catches (by weight).

The Pacific ocean perch is harvested by foreign vessels in the Gulf as well as along the Washington and Oregon coasts. Perch and other rockfish are harvested by U.S. vessels along the Washington, Oregon, and California coasts and off British Columbia, Canada. Because of the low abundance of other species of rockfish in the Gulf, Pacific ocean perch is the only member of this group considered of potential value to U.S. fishermen. However, recent NMFS (National Marine Fisheries Service) surveys in the Kodiak area indicate that their abundance has declined substantially since the 1961-63 survey, primarily due to the effects of foreign fisheries.(6)

FLATFISH OR FLOUNDER GROUP

GENERAL

Halibut is the only flounder being harvested by U.S. fishermen in the Gulf. Arrowtooth flounder, (turbot) and flathead, rock, yellowfin, rex, and Dover soles are potentially valuable due to their abundance and availability. These species are harvested in the Gulf or Bering Sea by foreign vessels. Dover, rex, rock, and English sole are landed by U.S. vessels from grounds off Washington, Oregon, and California.(6)

RESULTS OF EXPLORATORY TRAWLS - INTERNATIONAL PACIFIC HALIBUT COMMISSION

Flounders were the most abundant of the groundfish group encountered in the International Pacific Halibut Commission trawl surveys from 1961-1963 in the Gulf of Alaska. Trends in the Commission's data show: (1) the percentage of flounders in trawl catches gradually increased moving east and south from the Peninsula area, around the Gulf into the Yakutat area; (2) the abundance of flatfish was greater in the Peninsula and Kodiak areas than in the Kenai and Yakutat areas; (3) the Kenai area showed the lowest abundance of flatfish relative to the other areas during all seasons of the year and at most depths sampled; (4) the percentage of flounders in catches and the catch rates of flounders generally increased with increasing depth in the Peninsula and Kodiak areas (however, in the eastern portion this trend became less apparent, as shown in the Kenai area--there was no consistent trend in the Yakutat area); and (5) best catch rates (3,400 pounds per hour trawled) were achieved around Kodiak during the spring at depths of 200-260 fathoms.

Data acquired in exploratory trawls by the International Pacific Habitat Commission (IPHC) from 1961 to 1963 are comparable to those of the Bureau of Commercial Fisheries, which were conducted from 1950 through 1971. The following briefs highlight IPHC findings.(6,16)

Arrowtooth Flounder

Arrowtooth flounder (turbot) was the most abundant and frequently encountered species in the Gulf area surveyed. Only one other species, rex sole, was at all depths during each season throughout the area.

Information available from these trawl data shows the abundance of arrowtooth flounder to be highest in the western portion of the Gulf and particularl low in the Kenai area. During all seasons, the major portion of the population occurs in waters deeper than 100 fathoms and much of the population probably resides at depths exceeding limits of the survey. Higher densities will be found in shallower waters during the spring and summer relative to the winter distribution. While changes in seasonal depth distribution occurred in all areas, arrowtooth flounders were generally more abundant in shallower waters along the southeastern portion of the Gulf than in the northwestern portion. Highest average catch rates (2,500 pounds per hour trawled) were obtained from 200-260 fathoms in the Kodiak area during the spring, and catches averaged nearly 1,400 pounds per hour during all seasons in the Peninsula area in 150-199 fathom waters. Comparable catches were taken during the spring at depths of 100-149 fathoms in the Yakutat area.(6)

Flathead Sole

Flathead sole abundance was fairly consistent throughout the Gulf survey area. Due primarily to consistency in catches rather than specific areas of high density, this species ranked second in flounder abundance.

Data indicate that flathead sole cover a wide range of depths as well as geographic areas. While present at depths less than 50 fathoms and greater than 199 fathoms, highest densities occurred at 150-199 fathoms during the winter and 100-149 fathoms during other seasons. Catch rates in exploratory trawls were notably low at all depths during the winter. Again illustrating a wide and fairly uniform distribution, flathead sole never constituted over 25% of catches in an area-season-depth category but commonly constituted 10-16% of total catches.(6)

Rock Sole

Although rock sole ranked fourth in Gulf-wide flounder abundance, from IPHC data shows such a general treatment to be of little value. More specifically, rock sole was of considerable importance along the inner shelf in the Kodiak and Peninsula areas and of minor importance in the entire southeast portion of the Gulf. Highest densities occurred at depths of 1-49 fathoms in the Kodiak area during the summer and fall. Seasonal changes in depth appear minor compared with halibut; however, rock sole generally occupied a broader range of depths in the winter and spring than in the summer and fall. Limited fishing at depths less than 40 fathoms, where rock sole are known to be abundant during the spring, summer, and fall, may have resulted in low abundance levels within the 1-49 fathom interval.

Rock sole are particularly abundant south of Unimak and along the east side of Kodiak during the winter.(6)

Rex Sole

Rex sole was more evenly distributed geographically than and primarily located in waters deeper than 100 fathoms. Rex sole was the second most abundant flounder at depths greater than 150 fathoms. Although this species occurred in

all depth zones and areas sampled, by the IPHC, the level of abundance (pounds per hour trawled) was relatively low. Highest densities occurred during the spring in the Kodiak region between 200 and 260 fathoms. Average catches in other areas and seasons were generally less than 100 pounds per hour trawled at depths greater than 100 fathoms. Abundance decreases with decreasing depths and only traces of rex sole occurred in 1-49 fathom water. With the exception of the Kenai area, rex sole comprised between 1% and 10% of total catches by weight.(6)

Dover Sole

The IPHC survey indicated that the distribution and relative abundance of Dover sole was similar to rex sole. In general, Dover sole was less abundant and occupied somewhat deeper waters, primarily depths greater than 150 fathoms. Unlike rex sole, Dover sole abundance was considerably lower in the Peninsula area relative to other areas. Best catches were obtained in the Kodiak and Kenai areas during the spring and summer at the greatest depths sampled. Dover sole abundance and percentage of total catches increased sharply with increasing depth on the outer shelf and slope and suggests that a significant portion of this resource may extend to depths well beyond 260 fathoms.(6)

Butter Sole

Small amounts of butter sole occurred throughout the Gulf at depths less than 100 fathoms. They were not taken from depths greater than 200 fathoms. Geographically, this species was most abundant in the Yakutat area at depths less than 50 fathoms. In other areas, catches were usually in trace amounts except for Kodiak where they averaged 30-50 pounds per hour in the winter, spring, and summer along the inner shelf.(6)

Yellowfin Sole

Within the Gulf, catch rates of yellowfin sole and occurrence were highest in the Peninsula area, followed by Kodiak, Kenai, and a complete absence in the Yakutat area. Yellowfin were not captured at depths beyond 100 fathoms and were most prevalent in the 1-49 fathom zone. Within this depth zone, a maximum average catch rate of 32 pounds per hour was obtained during the summer in the Peninsula area, which constituted only 3% of the total catch.

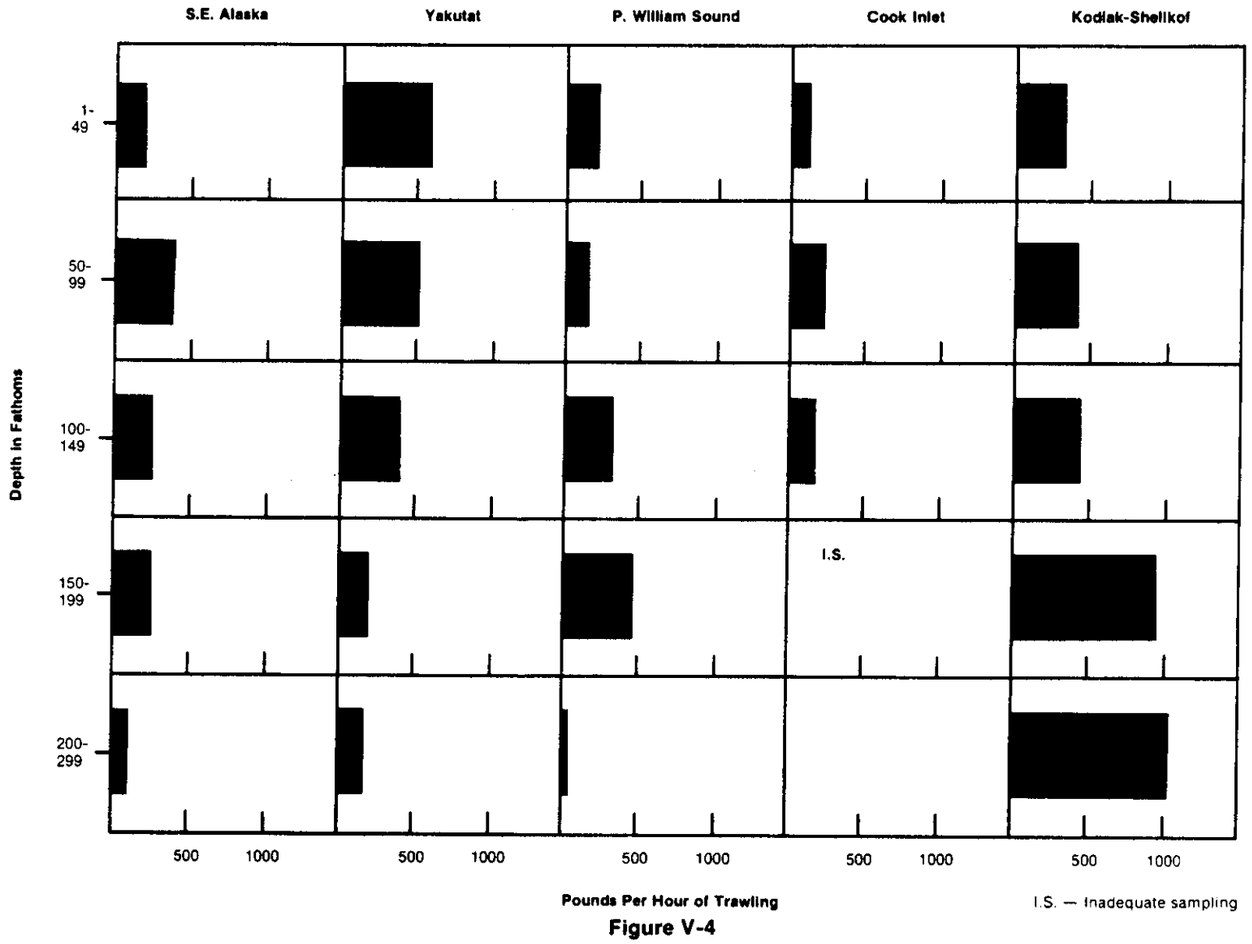
Starry Flounder

Starry flounder were located in IPHC trawls throughout the Gulf and were most abundant along the inner shelf of the Yakutat area. Their greatest abundance occurred at 1-49 fathoms. At these depths, except in the Yakutat area, average catch rates ranged from 1 to 50 pounds per hour and starry flounder usually comprised about 1% of total catches by weight. However, this species may form an important segment of the flounder community in the Yakutat area. There, average catch rates were 1,100 pounds per hour during the spring in 1-49 fathom water. It is also quite possible that this species is more abundant than indicated in other Gulf areas, again due to limited sampling in shallow waters.(6)

RESULTS OF EXPLORATORY TRAWLS -
NATIONAL MARINE FISHERIES SERVICE

Bureau of Commercial Fisheries (National Marine Fisheries Service) surveys from 1950-1971 reveal that flounders are present in all regions and depth zones of the continental shelf and slope in the Gulf of Alaska.(17) As a group, they have dominated the catches in the Gulf of Alaska regions. They are most frequently encountered in the offshore regions as compared to the inside waters of the Gulf. In the offshore regions as compared to the inside waters of the Gulf. In the offshore regions, flounders have been most abundant on the continental shelf (less than 100 fathoms) decreasing as it goes beyond the 150-fathom contour. The catch per hour of successful trawling for flatfish except halibut are given in Table V-3 and Figure V-4. The average catch rate on the inner shelf has been lowest in Cook Inlet and greatest in the Yakutat area. Catch rates were considerably higher at depths greater than 100 fathoms in the Prince William Sound and Kodiak regions. The Yakutat region showed the greatest abundance of flatfish in all depth zones sampled (Figure V-5). The arrowtooth flounder or turbot was the most frequently encountered, as well as the most dominant species, in the Gulf of Alaska. It dominated catches of all five regions, comprising about half of all the 15 flatfish species caught. In southeastern Alaska, turbot made up about 73 percent of total flatfish caught.(5) Total flatfish (except halibut) distribution in the Gulf of Alaska is shown in Figure V-6.

AVERAGE CATCH OF FLATFISH PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA



I.S. — Inadequate sampling

Figure V-4

Table V-3

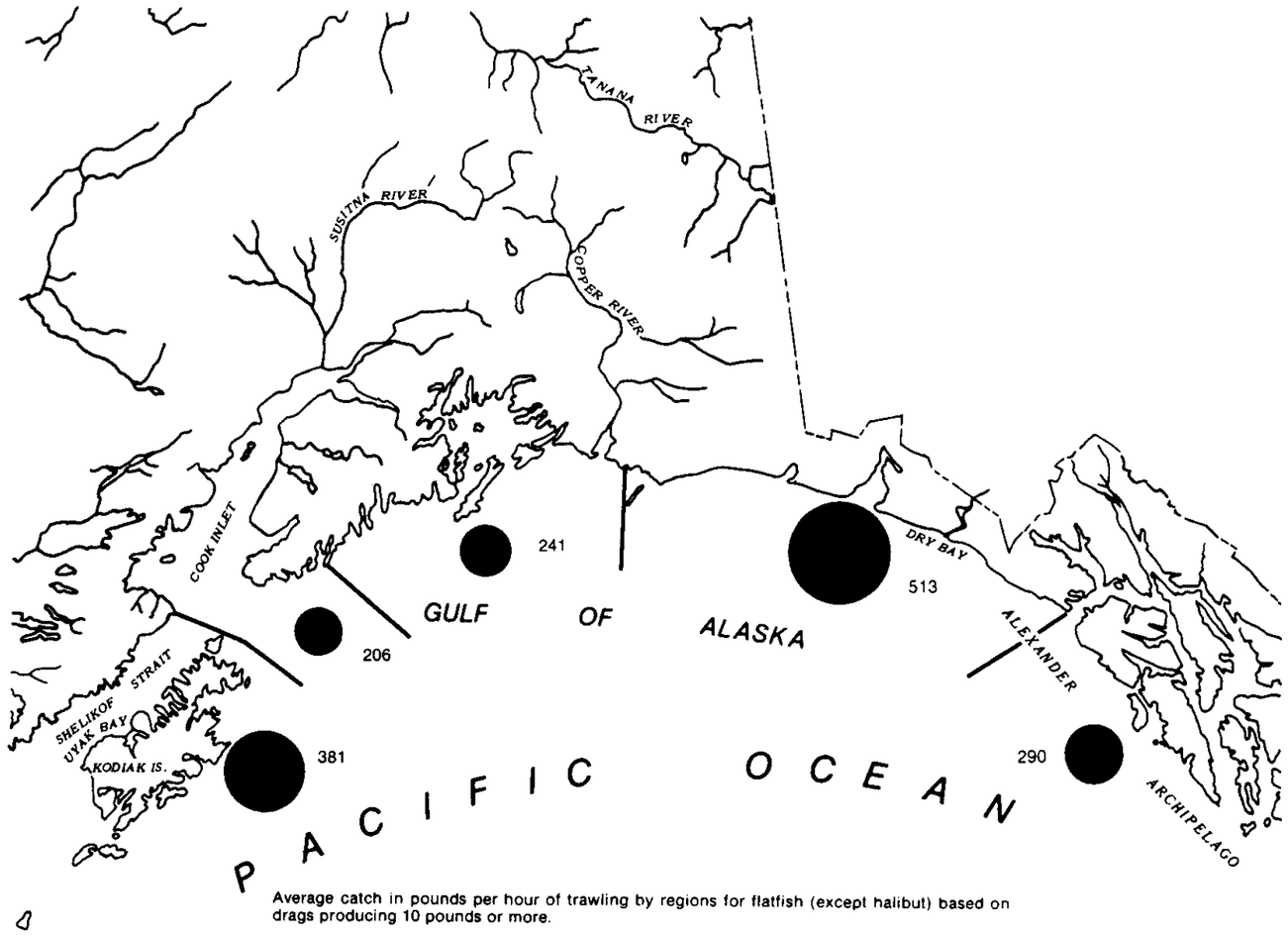
POUNDS OF FLATFISH CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA[1]

DEPTH FM.	S. E. ALASKA TOTAL CATCH	S. E. ALASKA FISHING EFFORT (HOURS)	S. E. ALASKA CATCH/ HOUR	YAKUTAT TOTAL CATCH	YAKUTAT FISHING EFFORT (HOURS)	YAKUTAT CATCH/ HOUR	P. W. SOUND TOTAL CATCH	P. W. SOUND FISHING EFFORT (HOURS)	P. W. SOUND CATCH/ HOUR	COOK INLET TOTAL CATCH	COOK INLET FISHING EFFORT (HOURS)	COOK INLET CATCH/ HOUR	KODIAK-SHELIKOF TOTAL CATCH	KODIAK-SHELIKOF FISHING EFFORT (HOURS)	KODIAK-SHELIKOF CATCH/ HOUR
1-49	2,029	10.6	191	20,261	30.7	660	9,116	43.0	212	554*	4.2	132	8,802*	32.5	271
50-99	39,126	107.4	364	44,459	81.0	549	35,827*	196.8	182	3,831*	17.1	224	41,292*	114.3	361
100-149	22,170	92.9	239	10,890	28.7	379	42,627*	133.5	319	1,002	4.6	218	17,897*	44.3	404
150-199	2,697	14.5	186	1,353	7.7	176	6,460*	13.5	479	165	1.0	I.S.[2]	3,805	4.0	951
200-299	345	2.5	138	550	3.1	177	805	7.4	109	-	-	-	4,120	4.0	1,030
300-399	31	1.0	I.S.[2]	-		-	-	-	-	-	-	-	-		-
TOTAL	66,398	228.9		77,513	151.2		94,835*	394.2		5,552*	26.9		75,916*	199.1	
Avg. catch/hr. for all depths			290			513			241			206			381

1/Flatfish data exclude halibut

2/Inadequate sampling

*Includes exploratory drag data for the period 5-31-69 to 7-25-71.



Average catch in pounds per hour of trawling by regions for flatfish (except halibut) based on drags producing 10 pounds or more.

Figure V-5

FIGURE V-6

SHELL OIL COMPANY

GULF OF ALASKA

FISHERY RESOURCES

PLOTTED FISHERIES DISTRIBUTIONS AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING DRAGS", N. J. WOLOTIRA, V. A. ASTRAKHANTSEFF, H. B. PARKS AND C. R. KITZ, N.M.F.S. EXPLORATORY FISHING AND BEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1950-1968.

PREPARED BY ZENAIDA D. MATURGO

DATE: | BY:

FLATFISH (EXCEPT HALIBUT)

• —● TRACE TO > 1000 LBS.

1969-1971

● >1000 LBS./DRAG

74

PACIFIC HALIBUT (Hippoglosus stenolepis)

INTRODUCTION

Pacific halibut (Hippoglosus stenolepis) have been recorded along 3500 miles of the North American coast from Santa Rosa Island off Santa Barbara, California, to as far north as Norton Sound (Nome), and 700 miles across the continental shelf in the Bering Sea.

NATURAL HISTORY NOTES

Halibut are generally described as a demersal species, implying a generally non-migratory life history. However, it is evident that halibut, at all stages of existence, undergo great horizontal and vertical changes. These changes relate to the general region of the continental shelf or slope at various stages throughout the halibut's life cycle.(20)

Halibut spawn on the continental slope at clearly defined places in close proximity to the bottom and at fairly specific depths. Eggs and larvae rise to the middle water layers and are transported by water masses great distances beyond the continental shelf. Later they settle as young or juvenile halibut chiefly on the shallow areas of the shelf far from the place of spawning.

While young or juvenile halibut from one to four years old are found close inshore and in some cases in concentrated numbers, the two- to four-year-olds are also very widely dispersed over the 100,000 square miles of the continental shelf in the Gulf of Alaska and southeastern Bering Sea. These very young fish also are not sedentary, exhibiting a pronounced contra-current migration eastward, occasionally as much as 1000 miles.

Adult halibut, five years and older, are found on the continental shelf and slope and are fished on clearly defined grounds, which vary with the seasons of the year. Notwithstanding their stability of occurrence on the same grounds from year to year and season to season, adults undergo extremely wide horizontal movements that may extend over 2,500 miles of the coast (Figure V-7).

Food sources of halibut also attest to its apparent ambivalence with respect to the continental shelf. Halibut are omnivorous, feeding on both plankters and benthic forms. Their diet may be sedentary, even attached invertebrates on the bottom species close to the bottom such as crabs, sand-lance or upper level forms including the clupeoids and other pelagic species.(20)

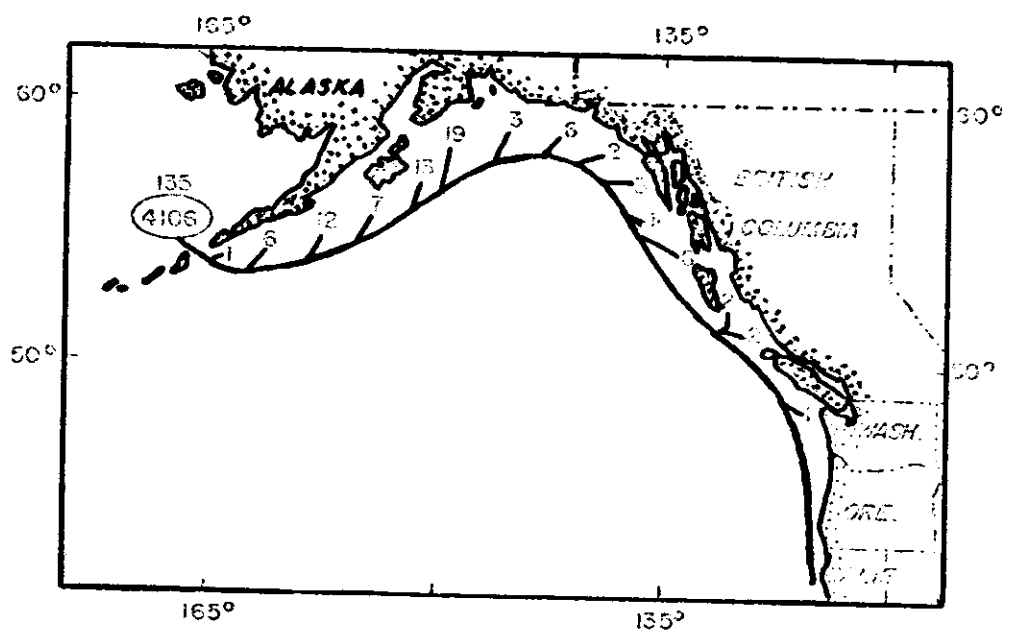


Figure V-7. Extensive migrations of halibut tagged in the Bering Sea.(20)

Size

Halibut are the largest of all flatfish, with a recorded maximum from the North American coast of 495 pounds caught off Petersburg, Alaska. The average size, in the commercial landings on the Pacific Coast, is between 30 and 35 pounds.

Age and Growth

Females are much faster growing and most of the larger fish are of that sex. No male over 125 pounds has been observed to date by the Halibut Commission.

Most of the halibut in the Commercial catches are between 10 and 15 years old, although the large females over 100 or 200 pounds attain an age of 25 years.

Spawning

Spawning takes place over a fairly protracted period of the year. From November to March, both males and females are found concentrated at places along the slope of the continental shelf in proximity to the bottom at depths from 125 to 250 fathoms (230 to 360 meters). Some of the more important spawning grounds are Capt St. James, Whaleback, Came Omanney, Yakutat Spit, Eastern Spit, Icy Bay Spit, "W", Seward Gully, Trinity Islands and Chirikof Island. The location of those in the northern arc of the Gulf of Alaska are shown in Figure V-8.(20)

The eggs, about 1/8 inch in diameter, are bathypelagic-laid and fertilized in proximity to the bottom, but, subsequently, drifting in the middle-to-upper water levels (Figure V-9).

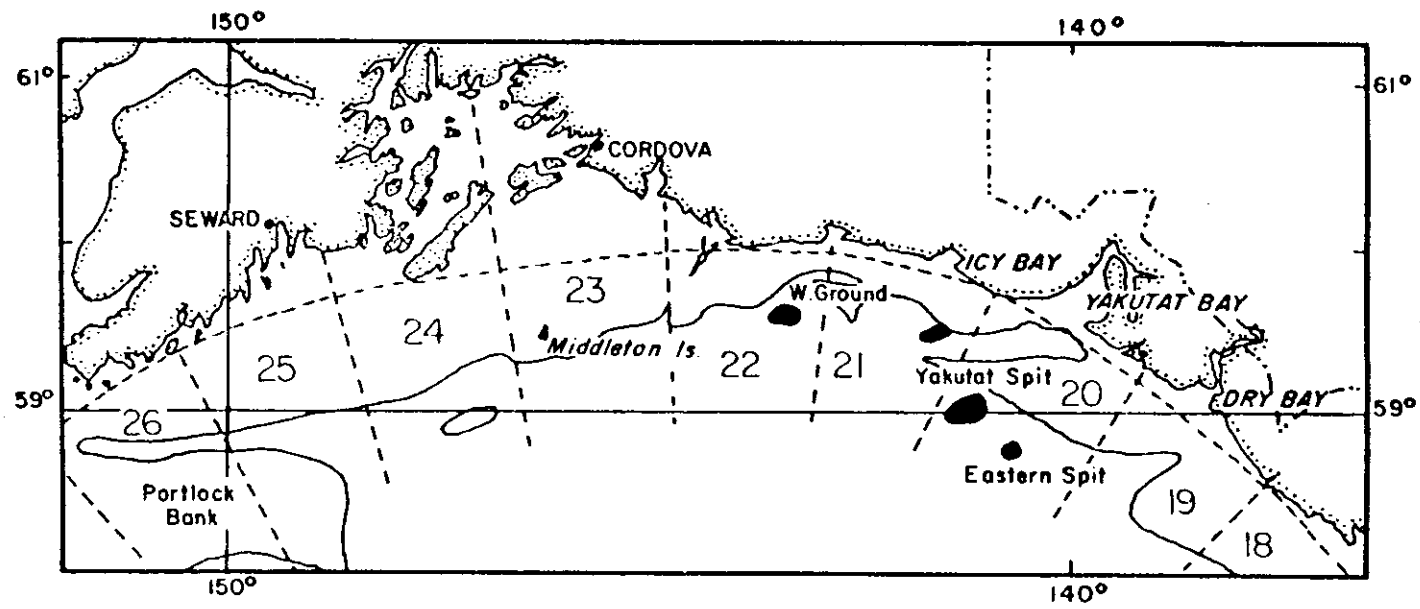


Figure V-8 Important halibut spawning grounds between Dry Bay and 150° W. longitude, Gulf of Alaska.

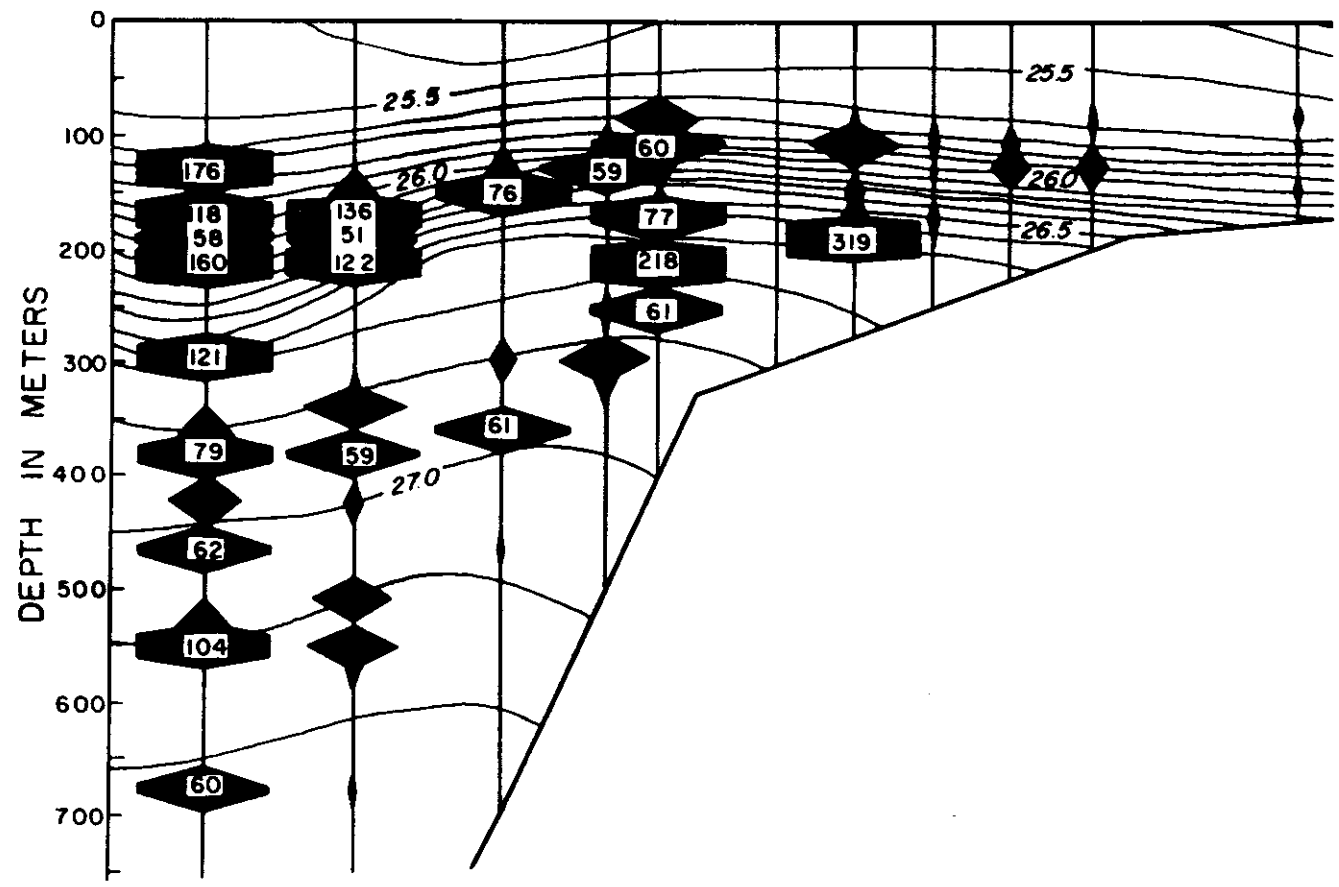


Figure V-9 Depth distribution of halibut eggs on a typical sampling section (Cape Cleare) across the continental shelf showing water density contours.

At this section (Cape Cleare), eggs were found as deep as 680 meters. Ninety-eight percent of the eggs were taken over depths greater than 275 meters, and 67 percent over depths more than 400 meters.

In the Gulf of Alaska, eggs are transported by westward-flowing ocean currents, and their displacement off the spawning grounds is fairly rapid (Figure V-10).

After about 15 days, they hatch, still living off the yolk sac.

Like the eggs, larvae and postlarvae are floating and are transported many hundreds, if not thousands, of miles by the westward-moving ocean currents. The velocity of some parts of this westward-moving Alaska Stream may reach as high as 10 knots.

The center of gravity of abundance of the early larval stages are still well over deep water outside the continental shelf (Figure V-11).[20]

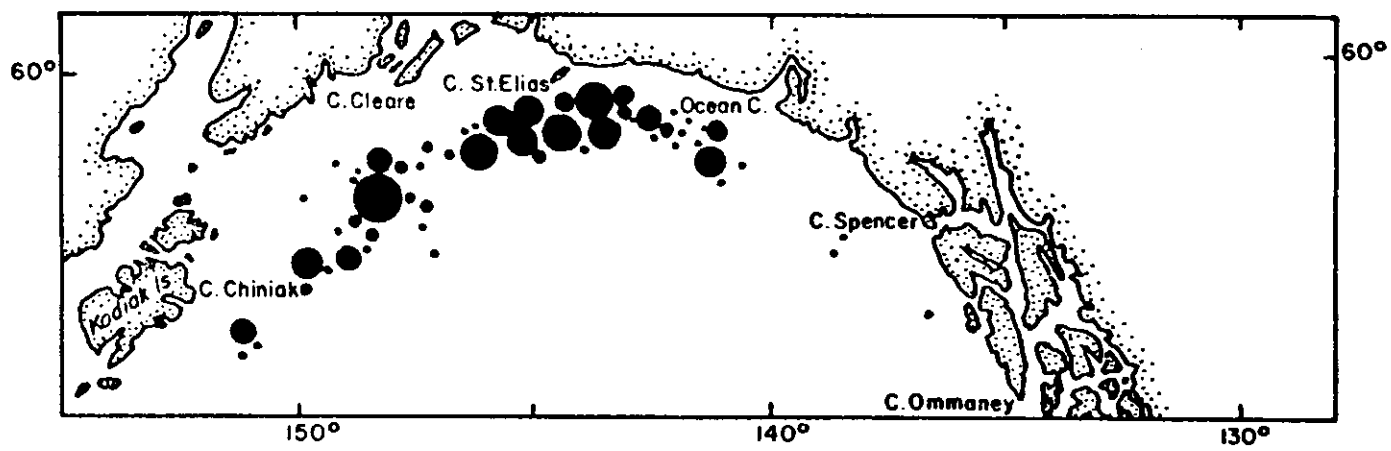


Figure V-10. Horizontal distribution of all halibut ova. The area of each circle is proportional to the total number of eggs taken at that locality in all the net hauls taken there.

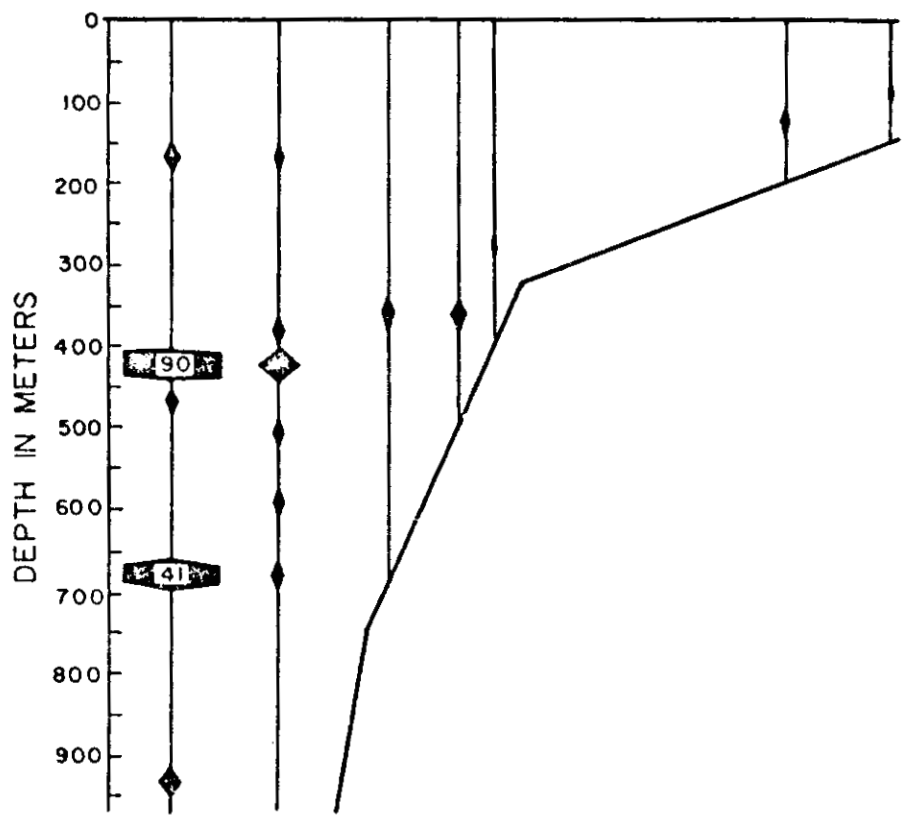


Figure V-11 Depth distribution of early larval stages.

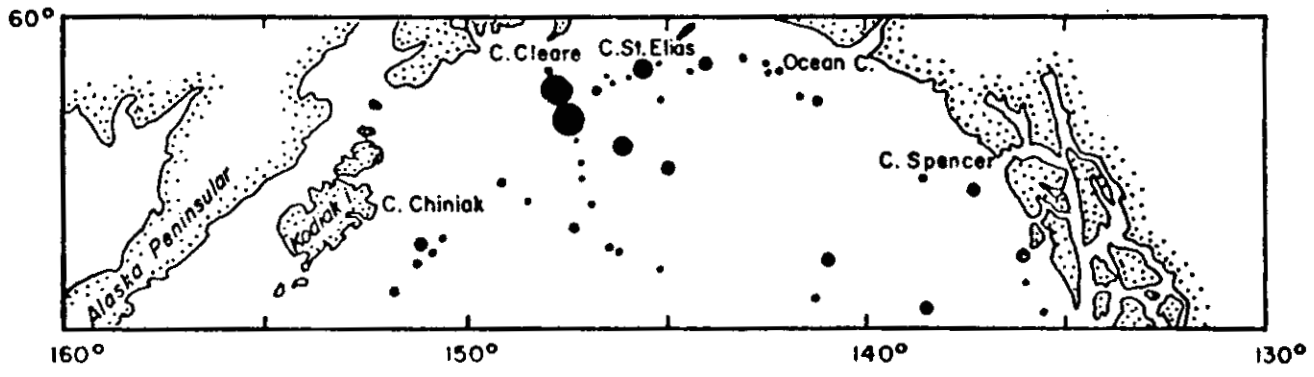


Figure V-12 Horizontal distribution of all Stage 2 larvae. The area of each circle is proportional to the total number of larvae that have been taken in that locality.

Although larvae show some movement toward the upper-water layers, 71 percent were over the abyssal depths beyond the slope. They are also displaced still further west (Figure V-12).

After rising into the surface-water layers (Figure V-13), the later stages tend to be moved by the prevailing winds toward the shallower sections of the continental shelf. About 93 percent have been taken in water averaging 12 m. However, it is "probably that young halibut settle down on the banks outside the bays and perhaps in deeper water than is indicated by their distribution in the net hauls." (20)

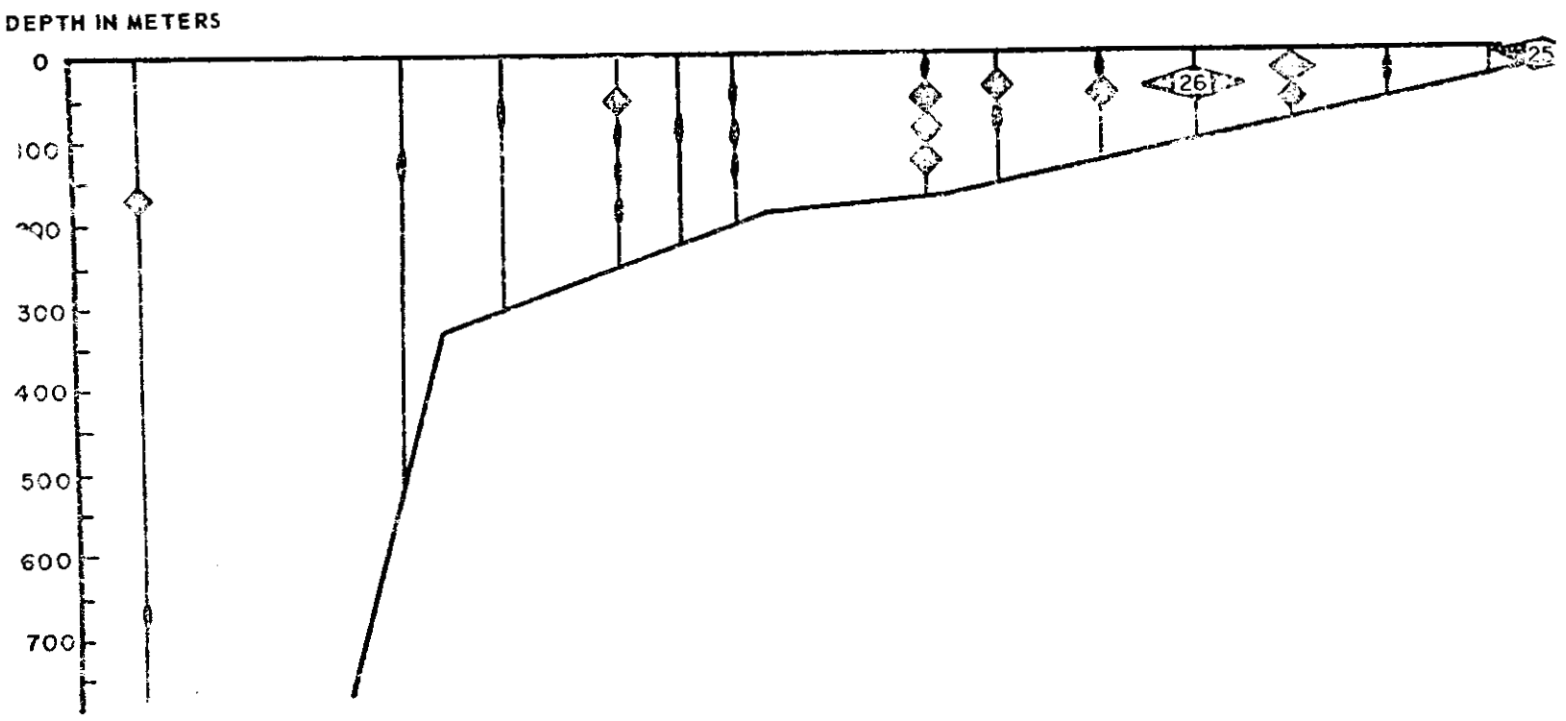


Figure V-13. **Distribution according to depth of all postlarvae belonging to Stages 5 to 9 inclusive.**

The larvae undergo metamorphosis and commence their bottom existence distant from the spawning grounds as juvenile halibut possessing the characteristic adult form. Thus, the floating eggs, the developing larvae and the postlarvae are dispersed far westward from the points where they were produced.

From a practical standpoint, knowledge regarding the size and locale of the spawning population and the number of its progeny, the direction and speed of their drift from one region to another during development have very important implications with respect to the proper husbandry of the resource. Such data had a direct and practical bearing upon the management strategies pursued by the Halibut Commission over the past 45 years. They would also be considered in any disturbance or alteration that may be made in the offshore environment.(20)

Recruitment

Young or juvenile halibut from 1 to 4 years old, those ages prior to entry into the Canadian and United States halibut fishery, are found on the continental shelf west of Cape Spencer and in southeastern Bering Sea.

In the Gulf of Alaska young halibut of ages 2 to 4 are distributed generally throughout the entire sampling area out to a depth of 100 fathoms (185 m.) and occasionally deeper. There is pronounced tendency for their abundance to be greater at depths 60 fathoms (90 m.) or less and to decrease in deeper water.

The destruction of young halibut in southeastern Bering Sea by the Japanese bottom fish fleets and Russian vessels is evident in the decline in the annual catch per standard haul by research vessels operated each year in the region by the Halibut Commission.

Tagging of juvenile halibut in southeastern Bering Sea has indicated a substantial emigration of such individuals, both as young or later as adults, to grounds as far east as the coasts of Southeastern Alaska and British Columbia. Such a movement is also consistent with the counter movement of

halibut eggs and larvae originating off the latter coast and drifting in the Alaska Stream to regions even as far west as the Bering Sea.

The crucial question is whether the remaining numbers of young in the Gulf of Alaska can alone provide sufficient recruits to the population of adults fished by the United States and Canadian setline fleets. Or will the loss of recruits from the Bering Sea result in a deficiency of recruits to all parts of the Pacific Coast, particularly in those years of average or below average year-class size?

Thus the dramatic decline in the supply of young halibut in the Bering Sea is a further unfavorable portent for the United States and Canadian setline halibut fishery, not only in the Bering Sea but also in the Gulf of Alaska and off British Columbia.(20)

RESULTS OF EXPLORATORY TRAWLS - NATIONAL MARINE FISHERIES SERVICE

Although Pacific halibut ranked second in frequency of occurrence among demersal fish species in the Gulf of Alaska recorded in Bureau of Commercial Fisheries exploratory trawls from 1950 to 1971, it dropped to the ninth place for most abundant species category. Halibut was taken in depth zones up to 299 fathoms in the Gulf of Alaska regions. Halibut catches were highest on the continental shelf at depths less than 100 fathoms (Table V-4), and catches generally decreased with increasing depth. Average catch per hour of trawling on the continental shelf was greatest in southeastern Alaska and Yakutat regions (Figure V-14). Although halibut occurred in the inside waters surveys, the catch rate was considerably less than in adjacent offshore regions with similar depth zones. The average catch of halibut per hour of trawling by regions is illustrated in Figure V-15.(5) Gulf-wide halibut distribution is shown in Figure V-16.

AVERAGE CATCH OF HALIBUT PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

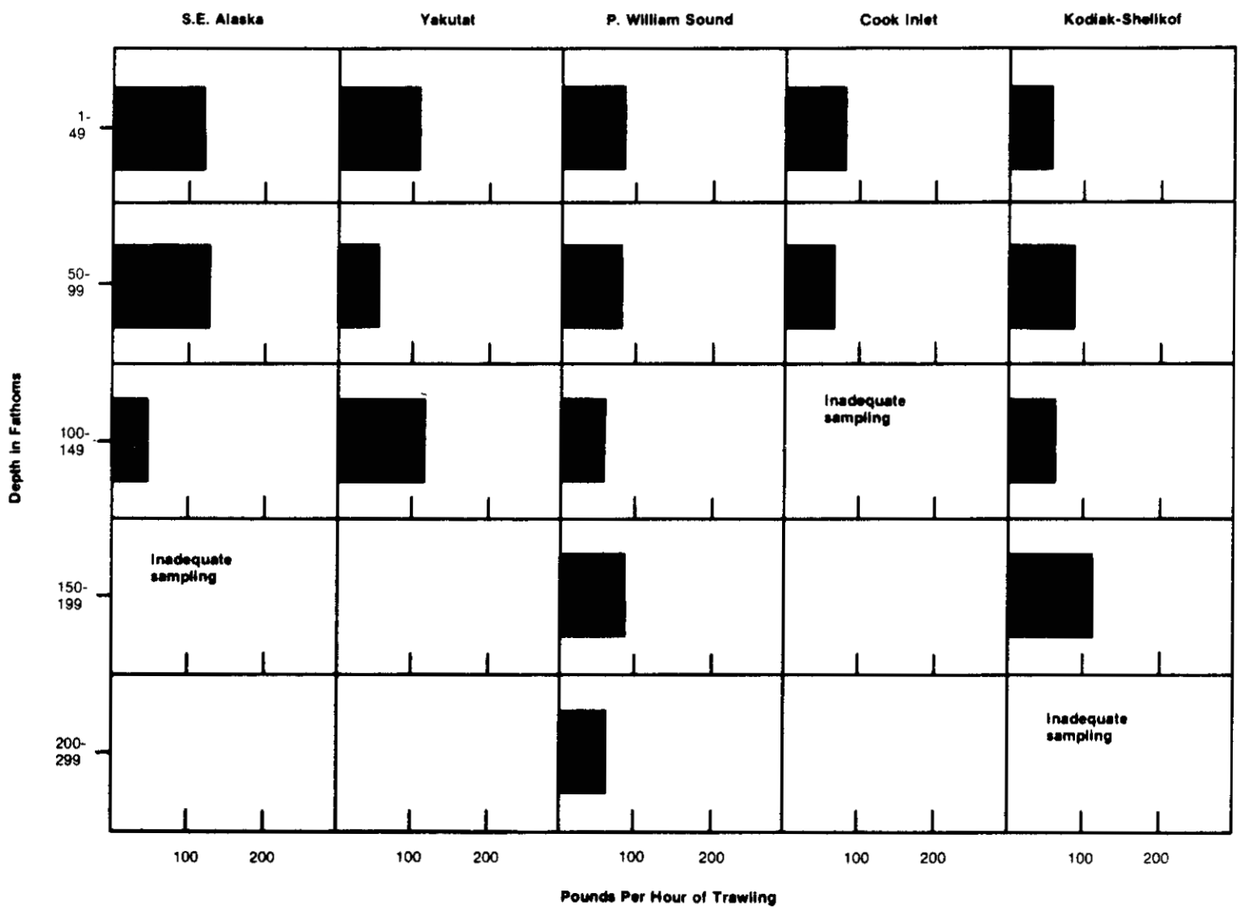


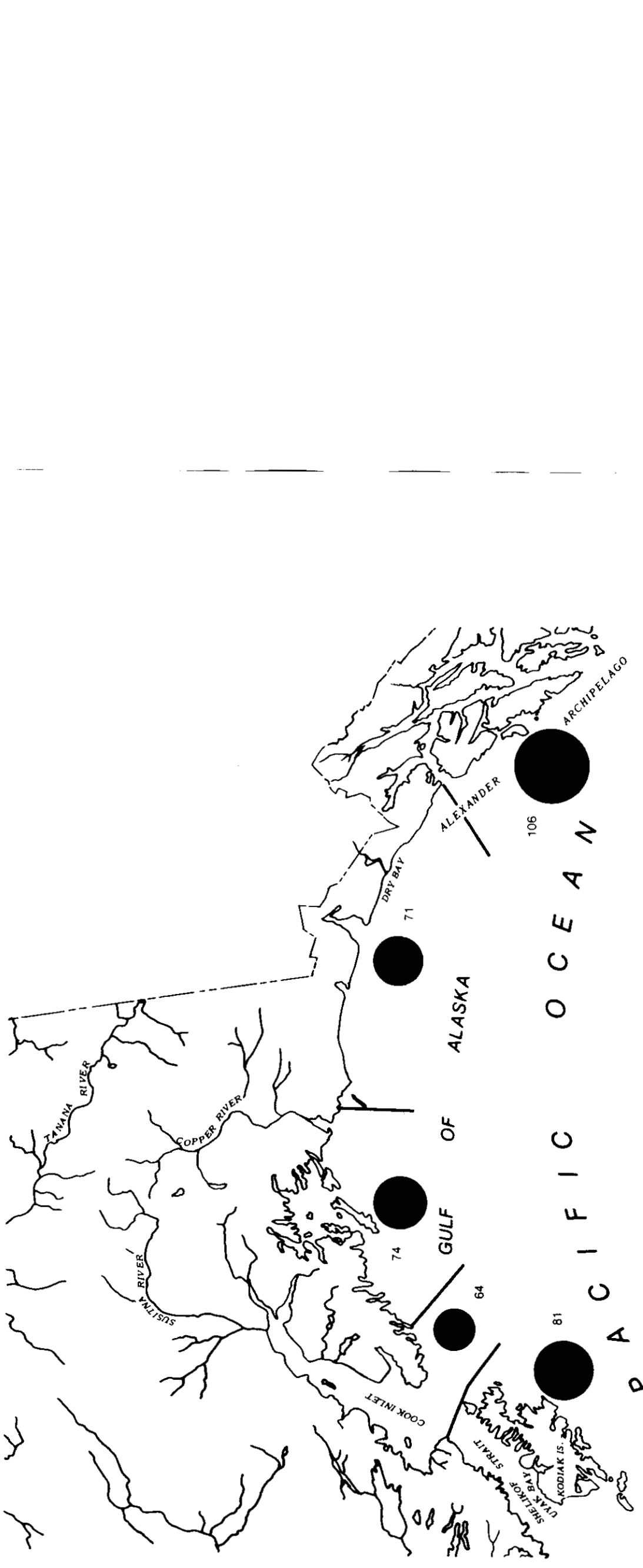
Figure V-14

Table V-4

POUNDS OF HALIBUT CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

DEPTH FM.	S. E. ALASKA TOTAL CATCH	S. E. ALASKA FISHING EFFORT (HOURS)	S. E. ALASKA CATCH/ HOUR	YAKUTAT TOTAL CATCH	YAKUTAT FISHING EFFORT (HOURS)	YAKUTAT CATCH/ HOUR	P. W. SOUND TOTAL CATCH	P. W. SOUND FISHING EFFORT (HOURS)	P. W. SOUND CATCH/ HOUR	COOK INLET TOTAL CATCH	COOK INLET FISHING EFFORT (HOURS)	COOK INLET CATCH/ HOUR	KODIAK-SHELIKOF TOTAL CATCH	KODIAK-SHELIKOF FISHING EFFORT (HOURS)	KODIAK-SHELIKOF CATCH/ HOUR
1-49	310	2.5	124	914	7.8	117	2,745	34.6	79	198	2.5	79	585*	11.4	51
50-99	2,584	20.2	128	1,118	22.4	50	5,335*	68.6	78	349*	5.7	61	3,244*	36.7	88
100-149	434	9.5	46	287	2.4	119	895	18.1	49	42*	1.0	I.S.	367	5.4	68
150-199	215	1.1	I.S.[1]	-	-	-	485	5.0	97	-	-	-	465	4.0	116
200-299	-	-	-	-	-	-	390	7.0	56	-	-	-	50	1.0	I.S.
TOTAL	3,543	33.3		2,319	32.6		9,850*	133.3		589*	9.2		4,711*	58.5	
Avg. catch/hr. for all depths			106			71			74			64			81

1/Inadequate sampling
*Includes exploratory drag data for the period 5-31-69 to 7-25-71.



Average catch in pounds per hour of trawling by regions for halibut based on drags producing 10 pounds or more.

Figure V-15

FIGURE V-16

SHELL OIL COMPANY

GULF OF ALASKA

FISHERY RESOURCES

PLOTTED FISHERIES DISTRIBUTION AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING GRABS", B. J. WOLOTIRA, B. A. ASTRAKHANTSEFF, R. G. PAREN AND C. R. NITZ, N.M.F.S. EXPLORATORY FISHING AND GEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1950-1968.

PREPARED BY ZENAIDA D. MATURGO

DATE: BY:

HALIBUT

TRACE TO > 200 LBS.

1969-1971

TRACE TO 200 LBS./DRAG

INTERNATIONAL PACIFIC HALIBUT COMMISSION TRAWLS

In IPHC exploratory trawls, halibut ranked third in flounder abundance over the entire area surveyed, in terms of pounds per hour trawled.

Geographically, this species was found to be most abundant in the Kodiak region, followed by Peninsula, Yakutat, and Kenai regions respectively. In all regions, highest densities occurred during the spring and summer on the inner shelf at depths of 1-49 fathoms and gradually decreased with increasing depth. Halibut were more dispersed over the shelf during the fall and winter. Best catches during the fall were taken at depths of 50-149 fathoms and 100-199 fathoms in the winter except for the Kenai area.(6)

THE HALIBUT FISHERY

Setline Halibut Fishing

The adult Pacific halibut 5 years and older form the basis for one of the more important single species fishery in the world. It is carried on by vessels of Canadian and United States registry and continued to be a setline operations.(20)

Commercial concentrations fished by Canadian and American vessels extend about 3000 miles from Northern California to St. Matthew Island in northeastern Bering Sea. (Figure V-17)

Setline fishing is conducted on the continental shelf and slope in depths usually between 45 and 150 fathoms. They may also fish as shallow as 15 fathoms or as deep as 300 fathoms, and there are instances where fishing has been conducted as deep as 600-700 fathoms.(20)

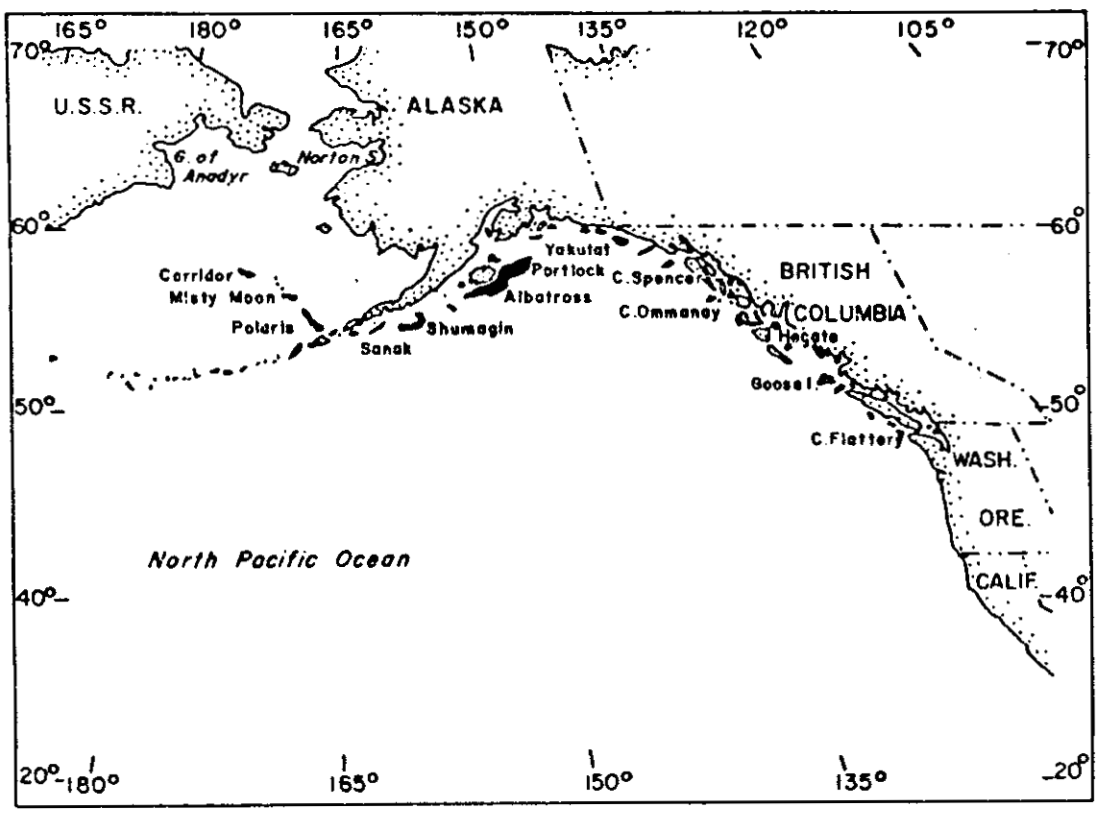


Figure V-17. Major fishing grounds of the North American halibut fleet.

Table V-5. Length of halibut fishing season south of Cape Spencer (Area 2) and west of Cape Spencer to Shumagin Islands (Area 3A) from 1966 to 1970.

	Area 2			Area 3A		
	Open	Close	Length (Days)	Open	Close	Length (Days)
1966	May 9	Aug. 25	108	May 9	Aug. 15	98
1967	May 9	Oct. 15	170	May 9	Oct. 15	170
1968	May 4	Oct. 15	175	May 4	Oct. 15	175
1969	May 7	Sept. 21	137	May 7	Sept. 22	138
1970	April 25	Sept. 21	149	April 25	Sept. 21	149

Areas 2 and 3A usually account for about 92 to 95 percent of the Pacific Coast catch of halibut and close on attainment of the prescribed catch limits or no later than some statutory date (Table V-5). Halibut landings by fishing grounds are shown in Table V-6.

The ground, Shumagin Islands and west, not including the Bering Sea, open with Area 3A, but usually close later. In some years, there are short, early seasons prior to the opening of Area 3A. In the Bering Sea, the various areas are opened for short, single-trip seasons very early in the spring; and, in some areas, there are short fall openings.

Total halibut landings for southeastern and south-central Alaska are shown in Table V-7 and Figure V-18.

Table V-6

HALIBUT CATCH BY FISHING GROUNDS IN ALASKA
1921 - 1973
(Thousands of Pounds)

Year	Southeastern Alaska (Dixon Entrance to Cape Spencer)	South Central Alaska (Cape Spencer to Trinity Islands)	Total
1921	10,222	14,744	24,966
1922	9,224	11,632	20,856
1923	9,717	21,598	31,315
1924	9,856	24,820	34,676
1925	7,987	22,160	30,147
1926	7,165	21,014	28,179
1927	7,419	22,623	30,042
1928	7,581	22,536	30,117
1929	9,847	22,272	32,119
1930	8,530	18,190	26,700
1931	7,390	14,608	21,998
1932	7,738	16,709	24,447
1933	8,154	19,558	27,712
1934	7,684	18,712	26,396
1935	7,852	19,221	27,073
1936	9,906	18,206	28,112
1937	9,395	18,349	27,744
1938	7,738	19,624	27,362
1939	7,770	19,078	26,848
1940	7,858	21,283	29,141
1941	7,806	20,421	28,227
1942	8,447	20,594	29,041
1943	8,265	20,282	28,547
1944	10,717	20,664	31,381
1945	9,069	19,626	28,695
1946	10,453	21,826	32,279
1947	10,164	19,846	30,010
1948	10,150	19,620	29,770
1949	9,818	20,948	30,766
1950	8,937	23,835	32,772
1951	10,126	20,861	30,987
1952	9,658	27,269	36,927
1953	8,554	22,836	31,390
1954	11,146	29,454	40,600
1955	8,988	23,062	32,050
1956	14,654	22,111	36,765
1957	12,349	22,849	35,198
1958	11,369	24,521	35,890
1959	13,162	25,364	38,526
1960	12,815	21,045	33,860
1961	12,372	23,068	35,440
1962	13,315	24,044	37,359
1963	10,291	22,310	32,601
1964	7,474	22,557	30,031
1965	12,150	22,979	35,129
1966	12,120	25,765	37,885
1967	9,489	19,659	29,148
1968	6,146	14,775	20,921
1969	9,376	20,081	29,457
1970	9,366	19,906	29,272

Table V-6 (Continued)

HALIBUT CATCH BY FISHING GROUNDS IN ALASKA
1921 - 1973
(Thousands of Pounds)

Year	Southeastern Alaska (Dixon Entrance to Cape Spencer)	South Central Alaska (Cape Spencer to Trinity Islands)	Total
1971	10,016	13,894	23,910
1972	5,765	14,714	20,480
1973	8,906	15,401	23,307

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

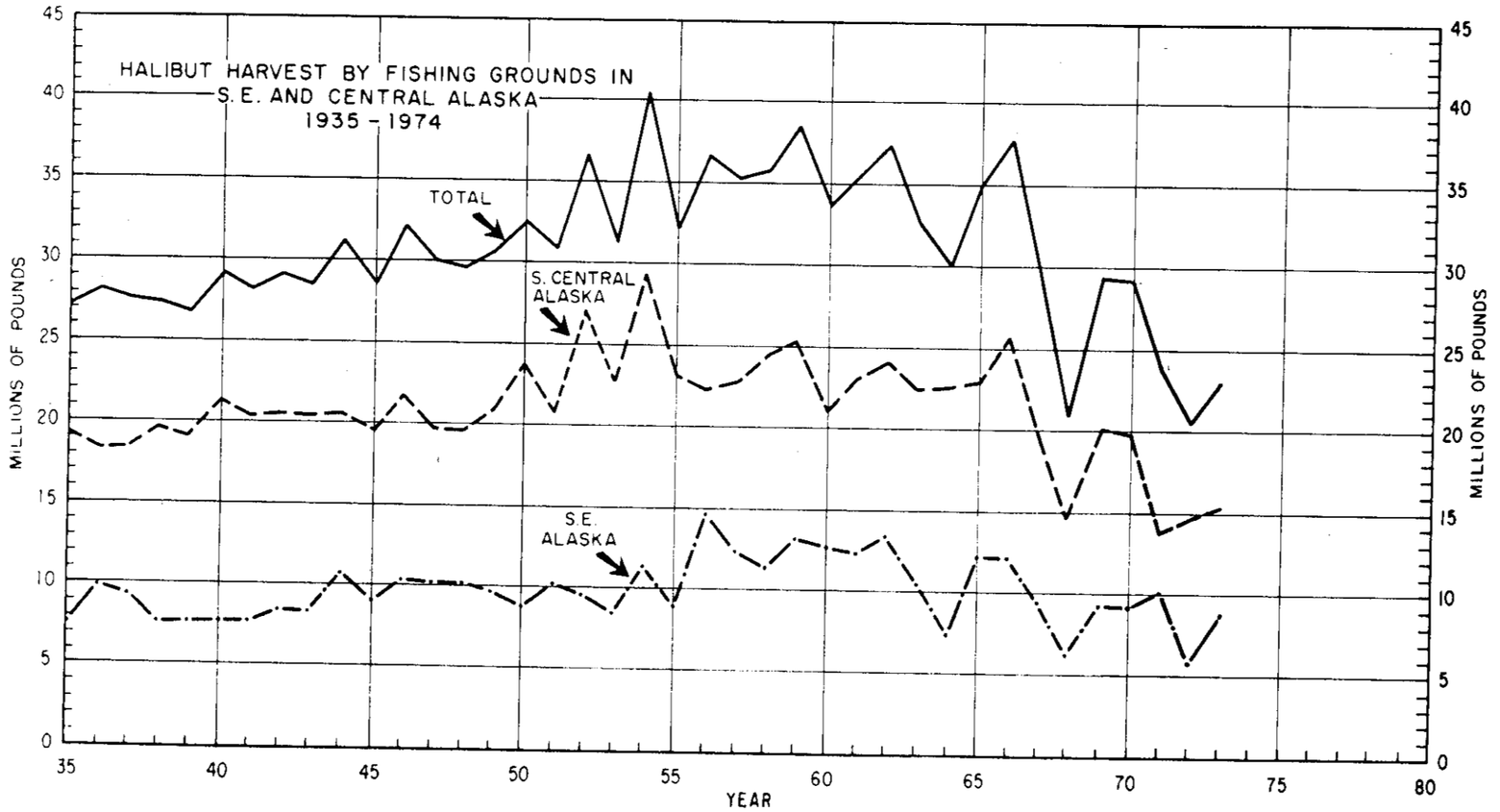


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Figure V-18

Table V-7

HALIBUT LANDINGS IN ALASKA
(SOUTHEASTERN & SOUTH CENTRAL ALASKA ONLY)
1935-1973
Thousands of Pounds & Thousands of Dollars

YEAR	QUANTITY	VALUE
1935	17,915	-
1936	19,982	-
1937	21,144	-
1938	20,974	-
1939	21,949	-
1940	27,840	-
1941	25,516	-
1942	31,470	-
1943	35,216	-
1944	36,477	-
1945	33,729	-
1946	35,853	-
1947	33,395	-
1948	35,077	-
1949	34,451	-
1950	38,555	-
1951	31,357	4,117
1952	31,919	4,534
1953	25,527	3,442
1954	33,241	4,353
1955	26,541	2,371
1956	33,222	4,804
1957	27,305	3,175
1958	26,488	3,349
1959	29,974	3,899
1960	28,404	3,110
1961	33,423	4,888
1962	36,792	7,466
1963	29,886	4,161
1964	22,758	3,573
1965	30,984	6,771
1966	33,354	7,815
1967	27,155	4,011
1968	12,800*	2,300
1969	21,100	6,300
1970	26,100	8,600
1971	23,910	7,236
1972	20,480	12,322
1973	23,307	17,110

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

Although there is a general distribution of halibut across the northern Gulf of Alaska, the density varies considerably throughout the region. Figure V-19 and V-20 illustrate the distribution of the United States and Canadian halibut catch in 1000's of pounds during 1961.(21) While the distribution of catches varies to some degree from year to year, the year 1961 can be regarded as a representative year, as the fishery was then well distributed over its full range. It also probably provided a more normal portrayal of the availability of adult and juvenile halibut as it was prior to the influx of large fleets of foreign trawlers. These data are based upon trawl data from the International Pacific Halibut Commission, May, 1961 - April, 1963.(16)

It is evident from these figures that the commercial catch from the inshore areas is much lower than those further offshore toward the continental slope, although Yakutat Bay produced a relatively large catch. In the fall, winter and early spring months, the commercial catches tend to be displaced still further offshore and in deeper water than during the current spring to early fall fishing seasons.

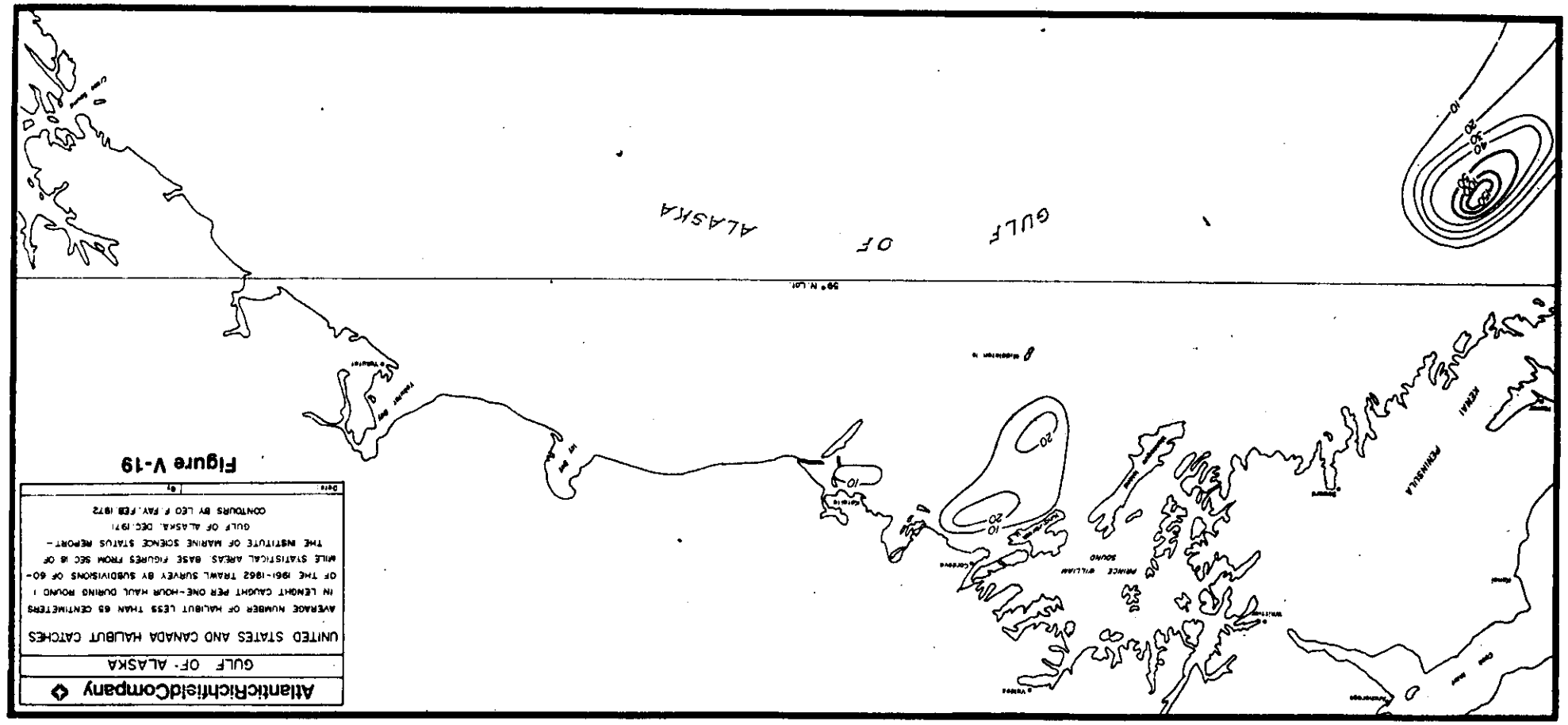

GULF OF ALASKA
AtlanticRichfieldCompany
GULF OF ALASKA
UNITED STATES AND CANADA HALIBUT CATCHES
AVERAGE NUMBER OF HALIBUT LESS THAN 65 CENTIMETERS IN LENGHT CAUGHT PER ONE-HOUR HAUL DURING ROUND 1 OF THE 1961-1962 TRAWL SURVEY BY SUBDIVISIONS OF 60-MILE STATISTICAL AREAS. BASE FIGURES FROM SEC 18 OF THE NBTITUTE OF MARINE SCIENCE STATUS REPORT-
GULF OF ALASKA. DEC. 1971
CONTOURS BY LEO F FAY. FEB 1972
Date
By

Figure V-19

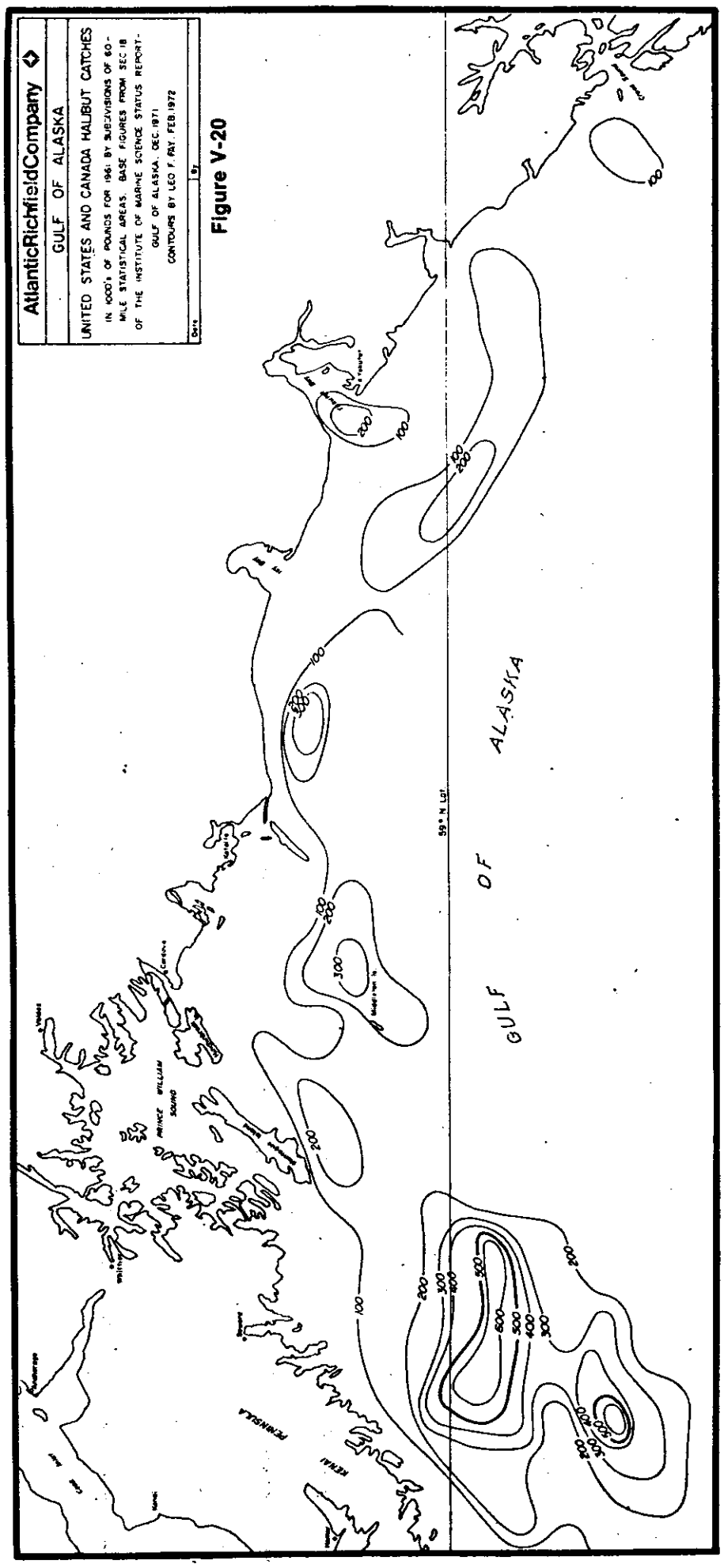

AtlanticRichfieldCompany
GULF OF ALASKA
UNITED STATES AND CANADA HALIBUT CATCHES
IN 1000's OF POUNDS FOR 1961 BY SUBDIVISIONS OF 60-MILE STATISTICAL AREAS. BASE FIGURES FROM SEC 18 OF THE INSTITUTE OF MARINE SCIENCE STATUS REPORT-GULF OF ALASKA. DEC. 1971
CONTOURS BY LEO F. RAY. FEB. 1972
Date
By
ALASKA
GULF OF
59° N Lat.
PRINCE WILLIAM SOUND
KENAI PENINSULA
100
200
300
400
500
600

Figure V-20

ROUNDFISH
(other than rockfish)

BLACKCOD OR SABLEFISH (Anoplopoma fimbra)

INTRODUCTION

Sablefish (blackcod) is an important species in the fishery by U.S. trawlers off Canada and the Pacific Northwest, and is the only member of the roundfish group which historically has been harvested by the United States in the Gulf.(6)

NATURAL HISTORY NOTES

The Pacific blackcod is distributed throughout the North Pacific from southern California to the coast of Japan. It is a deep-water species having been caught to depths of 530 fathoms, but juveniles are known to occur in shallower waters. They reach maturity at between six and eight years. Spawning takes place during the late winter, when the adult fish are in deep water. The eggs of the blackcod are pelagic. Food items consist of herring, sand lance and crustaceans.(19)

The highest population densities, based on catch percent effort, have been in the areas between Charlotte and Kodiak. The Vancouver and British Columbia areas, the latter especially, are known to have yielded good catches of blackcod in the past. The seasonal distribution pattern most conclusive is the uniformly higher catch rates during the third quarter, and the much lower catch rates during the fourth quarter.

The change in relative abundance between late summer and the fall months is most likely the result of a movement by blackcod to deeper water. Lower availability during the winter has been noted, and their occurrence in deeper water during this time has been reported. This wintertime movement is

associated with spawning. Eggs are pelagic, as apparently are the fry of blackcod. Small immature fish are known to frequent shallow bays and inlets during the late spring and early summer, often in the surface waters. Blackcod become more demersal in habit as they approach maturity. Locations of important spawning and rearing areas in the Gulf of Alaska have not been reported.(19)

SABLEFISH FISHERY

The major offshore fishing banks for sablefish are found off Baranof Island, from Cape Cross to Cape Fairweather, and from Middleton Island to Portlock Bank. This is reflected in the high exploratory catch rates in the Yakutat area (Figure V-21).(5) The major sablefish fishing areas in the inside waters of southeastern Alaska are located in Clarence Strait, Frederick Sound and Chatham Strait.

INTERNATIONAL PACIFIC HALIBUT COMMISSION
EXPLORATORY TRAWLS

In trawl surveys of groundfish conducted by the International Pacific Halibut Commission in the Gulf of Alaska, sablefish, in addition to pollock and Pacific cod, was taken throughout the area. Abundance was highest in the Kodiak and Peninsula regions. Small amounts of sablefish were taken at depths less than 100 fathoms and catch rates generally increased with increasing depths. This species was most abundant at depths where walleye pollock and Pacific cod abundance was low or declining rapidly. Although substantial quantities of sablefish undoubtedly occur in waters which are deeper than those surveyed, there is evidence of inshore movement during the spring and summer. Average catch rates reached a high of 500 pounds per hour trawled in the Kodiak region during the spring at 200-260 fathoms.(6)

NATIONAL MARINE FISHERIES SERVICE
EXPLORATORY TRAWLS

Sablefish were caught in exploratory trawls of the National Marine Fisheries Service in trace amounts in the inside waters of southeastern Alaska, Prince William Sound, Cook Inlet, and Shelikof Strait. They are known to be particularly concentrated within or near submarine canyons or gullies, preferring blue-clay or mud bottom or sand or rock bottom. Highest catches occurred beyond the 100-fathom zone in all regions with adequate sampling (Table V-8 and Figure V-22). Sablefish also are known to be abundant in the deeper waters along the continental slope. They were rarely taken by exploratory trawls on the continental shelf at depths less than 50 fathoms.(5)

Gulf-wide sablefish distribution, based on NMFS trawls, is shown in Figure V-23. Sablefish landings for the period 1941-1973 are shown in Table V-9.

AVERAGE CATCH OF SABLEFISH PER HOUR TRAWLED BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

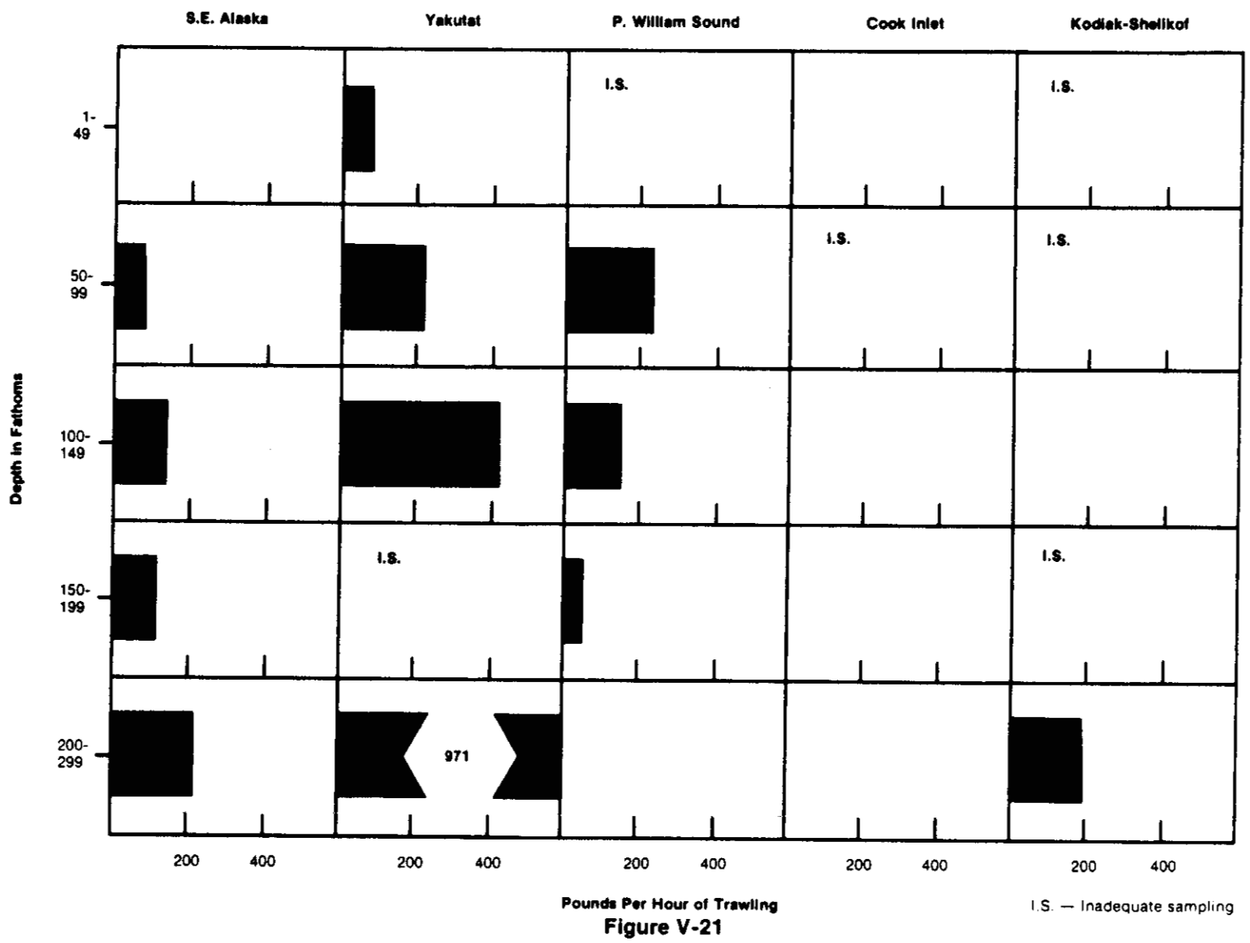


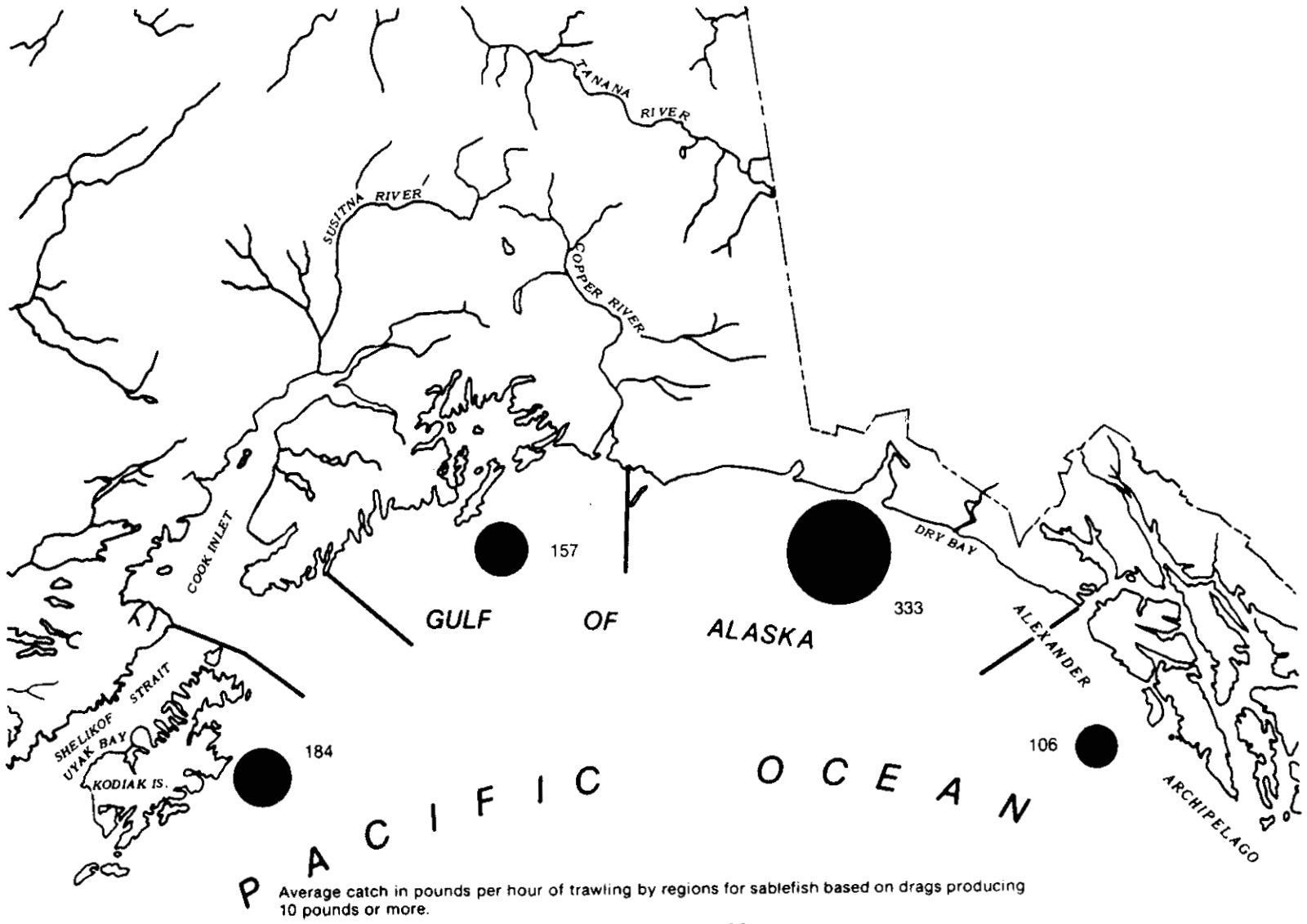
Figure V-21

Table V-8

POUNDS OF SABLEFISH CAUGHT PER HOUR OF SUCCESSFUL TRAWLING BY REGIONS AND DEPTH ZONES IN THE GULF OF ALASKA

	S. E. ALASKA			YAKUTAT			P. W. SOUND			COOK INLET			KODIAK-SHELIKOF		
DEPTH FM.	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR	TOTAL CATCH	FISHING EFFORT (HOURS)	CATCH/ HOUR
1-49	-	-	-	150	2.0	75	48	1.5	I.S.[1/]	-		-	40	1.0	I.S.
50-99	642	9.0	71	1,915	9.3	206	2,938	13.3	221	20		I.S.	702	2.0	I.S.
100-149	2,336	20.0	117	2,630	6.3	417	4,127	29.0	142	-		-	-	-	-
150-199	1,010	10.2	99	20	0.6	I.S.	100	2.0	50	-		-	35	1.0	I.S.
200-299	485	2.5	194	2,040	2.1	971	-	-	-	-		-	510	3.0	170
300-399	29	0.9	I.S.	-		-	-	-	-	-		-	-	-	-
TOTAL	4,502	42.6		6,755	20.3		7,205	45.8		20			1,287	7.0	
Avg. catch/hr. for all depths			106			333			157			I.S.			184

1/Inadequate sampling



Average catch in pounds per hour of trawling by regions for sablefish based on drags producing 10 pounds or more.

Figure V-22

FIGURE X-23

SHELL OIL COMPANY

GULF OF ALASKA

FISHERY RESOURCES

PLOTTED FISHERIES DISTRIBUTION AND ABUNDANCE BASED UPON "ALASKA NATIONAL MARINE FISHERIES SERVICE EXPLORATORY FISHING DATA", BY J. BOLOTINA, B. A. BEZBAHANTSEFF, R. B. FARRO AND C. R. HITZ, N.M.F.S. EXPLORATORY FISHING AND GEAR RESEARCH BASES, KODIAK ALASKA AND SEATTLE WASHINGTON, 1950-1966.

PREPARED BY FERNANDO B. MATURDO

DATE: BY:

SABLEFISH

TRACE TO 2000 LBS.

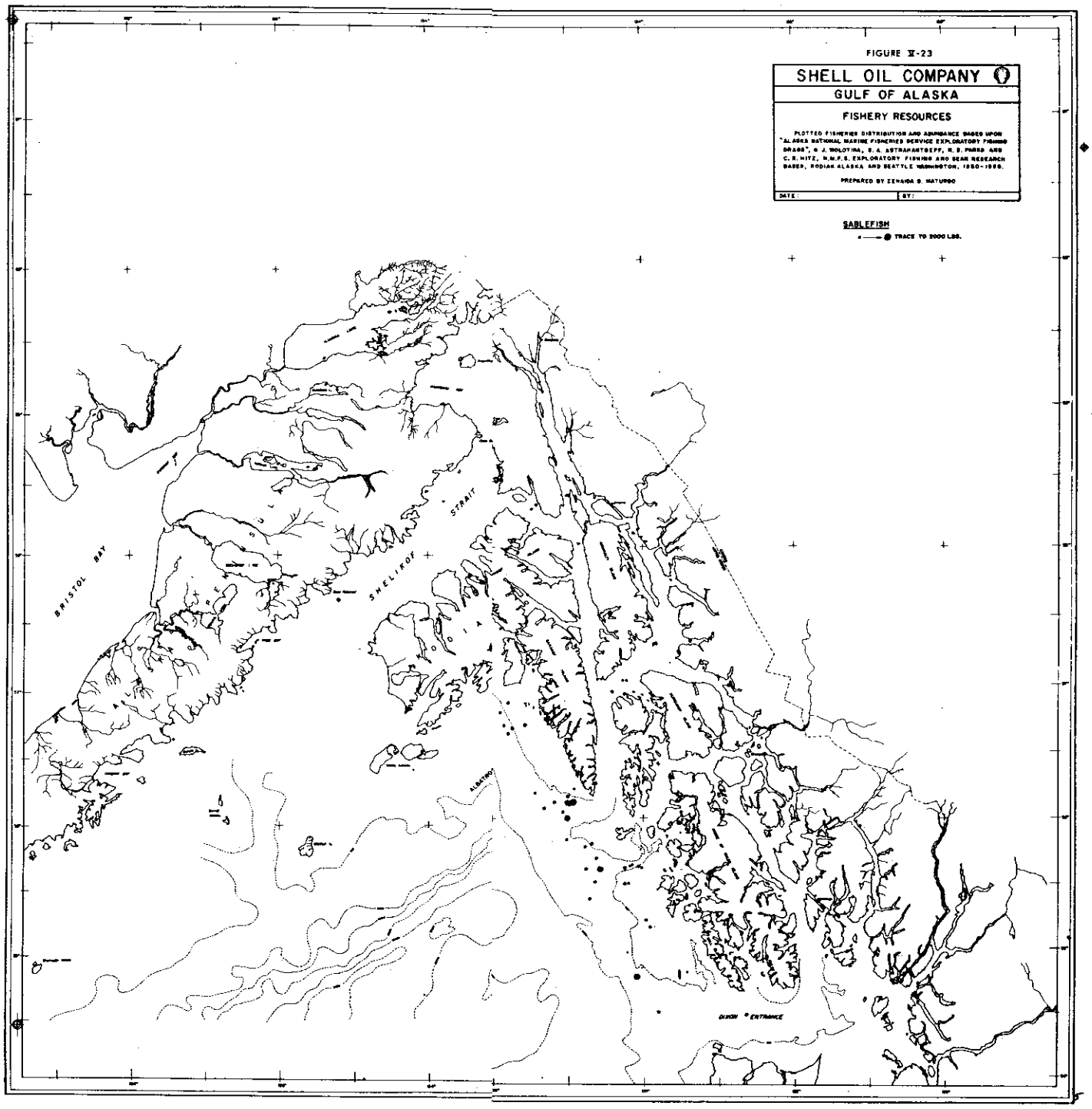


Table V-9

GULF OF ALASKA
SABLEFISH LANDINGS
1941-1973
Thousands of Pounds & Thousands of Dollars

	SOUTHEAST ALASKA		CENTRAL ALASKA		TOTAL	
Year	Quantity	Value	Quantity	Value	Quantity	Value
1941	4,071	81	-	-	4,071	81
1942	8,123	455	-	-	8,123	455
1943	6,628	493	-	-	6,628	493
1944	7,385	804	-	-	7,385	804
1945	8,349	914	2	<1	8,351	915
1946	9,019	740	-	-	9,019	740
1947	1,228	111	-	-	1,228	111
1948	6,493	706	20	1	6,512	708
1949	5,728	426	25	2	5,753	428
1950	955	36	-	-	955	36
1951	5,350	490	465	40	5,815	530
1952	1,790	141	14	1	1,804	142
1953	3,547	251	-	-	3,547	251
1954	4,702	335	20	1	4,722	336
1955	4,172	282	-	-	4,172	282
1956	2,750	186	-	-	2,750	186
1957	4,966	275	-	-	4,966	275
1958	1,541	114	-	-	1,541	114
1959	2,312	187	-	-	2,312	187
1960	2,933	288	38	4	2,971	292
1961	1,334	160	3	<1	1,337	160
1962	1,506	172	2	<1	1,508	172
1963	1,358	125	2	<1	1,360	125
1964	2,587	289	-	-	2,587	289
1965	2,311	226	-	-	2,311	226
1966	2,178	259	133	14	2,311	147
1967	1,992	193	96	9	2,088	202
1968	248	32	<1	<1	248	32
1969	665	65	-	-	665	65
1970	803	148	11	2	814	150
1971	573	95	21	3	594	98
1972	1,653	455	6	1	1,659	456
1973	1,872	467	38	6	1,910	473

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

WALLEYE (PACIFIC) POLLOCK
(Theragra chalcogrammus)

INTRODUCTION

Pacific pollock (Theragra chalcogrammus) is a member of the same family (Gadidae) as cod, haddock and whiting. At least three common names apply to pollock of the North Pacific - the Alaska pollock, the walleye pollock and the Pacific pollock. The latter name, with a slight spelling change (Pacific pollack), has been preferred by some U.S. processors.

Pacific pollock has a broad geographical distribution throughout the northern perimeter of the Pacific Ocean from the Sea of Japan to waters off California. Its centers of abundance lie in the Sea of Japan, off the islands of Hokkaido and Sakhalin, off the Kamchatka Peninsula and the northern Kurile Islands, the eastern Bering Sea, and the western Gulf of Alaska. Abundance declines in the eastern Pacific off British Columbia and southward, although occasionally large catches are taken in British Columbia and Washington waters.

NATURAL HISTORY NOTES

Like many of the commercially sought groundfish of the subarctic Pacific, pollock spawn during the winter to early summer. The fertilized eggs rise to near surface waters where hatching takes place. The larvae remain in surface waters until they develop into miniatures of the adults. As these young fish develop, they become more bottom dwelling in their habits, although daily vertical movements in the water column do occur in both juvenile and adult fish.

Growth is rapid during the first three to four years of life. It is during their third and fourth year, at about 12"-16", that they first reach maturity and may reach more than 27" in length. They are much like herring, ocean perch and other abundant pelagic and semi-pelagic fish in that they prefer small swimming crustaceans (euphausiids and amphipods) and small nektonic fish (smelt, herring) for food.

THE POLLOCK FISHERY

The Pacific pollock is the largest of the utilized fishery resources in the North Pacific. In 1970, more than 3-million metric tons were caught, almost equal to that of cod from the North Atlantic. Preliminary data for 1971 show that the Pacific pollock catch reached almost 3.7-million metric tons, which would place pollock second only to the Peruvian anchoveta as the world's most abundant species.

Until recently, almost the entire catch of pollock was used domestically by the principal pollock fishing nations - Japan, USSR, and Korea. Within the past three years, the Japanese export of frozen pollock blocks to the United States has begun to reach significant proportions.

The largest fraction of the total Pacific pollock catch is taken in the eastern Bering Sea. The U.S. Government has expressed concern about the status of this resource, and in recent years, the condition of the Bering Sea pollock stocks has been an important topic of discussion in fishery meetings between the United States, Japan, and the Soviet Union.

The development of a large scale U.S. fishery would require fishing vessels of sufficient size and capabilities, such as the large combination type vessels used in the U.S. Alaskan crab fishery. Capital would be needed for processing plants and automated equipment to offset labor costs. Nevertheless, Walleye (Pacific) pollock is regarded as one of the most potentially important species to the development of groundfish fisheries in the Gulf of Alaska.

EXPLORATORY TRAWLS -
INTERNATIONAL NORTH PACIFIC HALIBUT COMMISSION

In exploratory trawls by the International Pacific Halibut Commission from 1961-1963, most pollock were caught at depths of 100-199 fathoms where they occurred in 72-100% of all tows in the Peninsula and Kodiak areas. Catches and occurrence decreased rapidly in 50-99 fathom waters, and at depths exceeding 199 fathoms.

Highest average catch rates were obtained during the summer in the Kodiak region at depths of 150-199 fathoms and during the fall in the Peninsula region at 100-149 fathoms.(6)

EXPLORATORY TRAWLS -
NATIONAL MARINE FISHERIES SERVICE

In recent years, there has been an increased interest in the bottom-fish resources of the Kodiak Island region. In the spring of 1971, some Kodiak fishermen made exploratory ventures to determine the availability of pollock and cod. One vessel reported single-trawl catches as large as 40,000 lbs. of pollock. A small fishery for pollock and cod took place in the spring of 1972.

The National Marine Fisheries Service conducted trawl surveys to determine the relative abundance of bottomfish in the Gulf of Alaska, and in the spring and late summer of 1973 this type of activity was devoted essentially to pollock. The survey was directed to waters off the coast of Kodiak where exploratory fishing activities and Japanese pollock catch data suggested some abundance. Distribution, relative abundance, and size of fish related to geography and depth were surveyed.(22)

Catch rates for pollock in these National Marine Fisheries Service surveys, as contrasted with earlier IPHC surveys, indicate that pollock abundance in the Gulf has increased substantially during the last decade. Pollock is regarded as a species of considerable potential value in the Gulf, and large quantities are presently being imported from Japan for use as fish sticks.(23)

The bottom trawl survey, in which preselected localities were fished, revealed that pollock were most abundant where the bottom depth was from 60 to 130 fathoms. Mean catch rates were 1,560 lbs. per hour from 60 to 100 fathoms and 1,960 lbs. from 100 to 130 fathoms. At bottom depths shallower than 60 fathoms or greater than 130 fathoms, the catches of pollock were considered insignificant with less than 40 lbs. caught per hour.

Additional bottom twos were made in those areas in which the bottom trawl survey at preselected stations showed a high availability of pollock. One such area was in the gully that runs seaward from off Cape Barnabas. The pollock catch rates in this area ranged from 3,400 lbs. to 7,600 lbs. per hour.(6)

Bottom-trawl catches close to shore consisted of a mixture of juveniles and adults. In contrast, only adults were encountered further offshore. These patterns of availability, in both size of fish and relative abundance, may only be characteristic of the summer. During other seasons they may be quite different.

GROUNDFISH: SUMMARY ASSESSMENT

From the most recent data available, the Kodiak and Yakutat areas are important areas for the most important groundfish species in the Gulf of Alaska, the Pacific ocean perch.

From the biological standpoint, the Kodiak and Yakutat areas are particularly important to ocean perch production. Sampling surveys for ocean perch larvae indicates densities to be highest in the Yakutat area, and second highest in the Kodiak area during the April-July period. The distribution of larvae is influenced by water current patterns, but larvae were most prevalent in the water column over depths of 90 to 350 fathoms. Ocean perch apparently inhabit the subsurface water layers until their second year of life, at which time they become demersal, inhabiting progressively deeper waters as they increase in size. Densities of adult fish, as reflected by catch-per-unit effort figures for the trawl fleets, appear lower in the Kodiak and Yakutat areas than in more westerly areas. However, the generally higher trawl catches and amounts of effort in the Kodiak and Yakutat areas suggest that more of the ocean perch stock is available to capture in these latter areas.

The Yakutat and southeastern areas have been the major producers of the blackcod (sablefish) catch in the Gulf of Alaska, with seventy-nine percent of the total Japanese longline catch in 1968 coming from these areas. The southeastern area alone accounted for fifty-three percent of the total effort and catch. Relatively lesser catches came from the Kodiak and Charlotte areas. Densities of blackcod as indicated by longline catch rates, are similar from Charlotte to Kodiak. Shumigan and Chirikov appear to be areas of lesser

abundance. Areas important for spawning are not known, but it is known that spawning takes place in the winter in deep water. The eggs and fry of blackcod are pelagic and may be found at some distance offshore. Young fish are known to inhabit shallow waters of bays and inlets.

Alaska pollock, pacific cod and turbot (arrowtooth flounder) are lightly exploited in the Gulf of Alaska, although probably abundant. Both the pollock and cod spawn in the spring in relatively shallow waters. Pollock eggs are pelagic, while those of the cod are demersal. Little is known of the distribution of either larvae or adults of these species.

Alverson et al (1964)[15] have indicated turbot to be the most abundant flounder in explorations of the northeast Pacific occurring in about ninety percent of all trawl tows and comprising from twenty-four to forty-eight percent of all catches in the Gulf of Alaska. Turbot made up between seventy-two and one hundred percent of all flounder catches at depths between 50 and 299 fathoms and was the dominant flounder at depths greater than 49 fathoms in the Prince William Sound and Shelikov areas.

The economic potential of these slightly or completely unexploited species must be left primarily to speculation. Alverson et al (1964)[15] have estimated the standing stocks in the Kodiak and Yakutat areas for Alaska pollock, Pacific cod and turbot to be about 21,000, 42,000 and 263,000 metric tons, respectively.*

*Their estimate of the standing stock of ocean perch at 125,000 m.t. in the Kodiak and Yakutat areas appears reasonable since the estimated recent annual catches of this species in those areas has been around 50,000 m.t. Their estimate for the Aleutian area is too low at 20,000 m.t. since at least that much and probably more has been caught annually by Japan and the U.S.S.R.[23]

HERRING

INTRODUCTION

Herring range throughout nearly all temperate waters of the northern hemisphere. Its habit of concentrating in dense schools has made it a profitable resource for ocean exploiters for centuries, especially in the waters of the North Atlantic Ocean. The Pacific herring, Clupea palassii, a species closely related to the Atlantic herring, but differing from it in several life history characteristics, is widely distributed in the Pacific. It has sustained commercial fisheries all along the North Pacific rim from the northwest United States up into the arctic and down again to the eastern coast of Korea.(24)

NATURAL HISTORY NOTES

Spawning occurs throughout the spring months, slightly earlier in the more southern areas. The spawning period in southeastern Alaska is generally March through May, while around Kodiak Island most spawning occurs from late April through early June. There is some evidence that herring home to spawning areas and have a preference for salt-water areas of relatively low salinity. Spawning takes place in shallow water, less than 10 fathoms and, in many areas, in the intertidal zone completely. The liberated eggs are adhesive and are most often found attached to seaweed along the shore, although some spawning is done on gravel substrate. There are many spawning locales throughout Alaska, but the major spawning areas are located in southeastern, Prince William Sound and around Kodiak Island.(24)

A United States herring fishery in the Gulf of Alaska has been in operations for many years but at varying intensities due to apparent fluctuations in abundance of herring. The primary areas of herring production have been southeastern Alaska (Dixon Entrance to Cape Suckling - about two hundred and fifty miles west of Yakutat Bay) and central Alaska (Cape Suckling to Unimak Island). The major fishing areas within central Alaska are Prince William Sound and Kodiak Island. (Figure V-24) Almost all herring are caught with purse seines. In recent years, a fishery for herring roe and eggs attached to kelp has developed in both southeastern and central Alaska, as well as trace amounts from western Alaska. Much of this production is harvested directly from the herring spawning grounds. Historically, the fishery has been centered in southeastern Alaska, but major fluctuations in catch have occurred. For example, a shift in production from southeastern to central Alaska occurred in the late 1930's. More recently, almost all the catch has come from southeastern Alaska, until the late 1960's, when about equal amounts were caught from both southeastern and central Alaska.(24)

The current herring fishery in Alaska, although producing less than its earlier years, yields a relatively high value per pound, owing to the recent development of the herring egg fishery. (Table V-10) However, an additional and probably much higher value of herring as a forage fish for other more valuable species, such as salmon, needs to be noted. In spite of the importance of herring in the food chain, little is known of their current abundance and distribution in Alaska. Information is needed concerning the size of the resource, and concerning the seasonal, annual and other changes in distribution of feeding and spawning members of the population.(24)

Table V-10
SEA HERRING AND KELP WITH HERRING EGGS LANDINGS IN ALASKA (SOUTHEASTERN AND SOUTH CENTRAL ALASKA ONLY) 1935-1973
Thousands of Pounds & Thousands of Dollars

Year	SEA HERRING		KELP (WITH HERRING EGGS)	
	Quantity	Value	Quantity	Value
1935	225,800	-	-	-
1936	209,100	-	-	-
1937	261,400	-	-	-
1938	231,000	-	-	-
1939	229,700	-	-	-
1940	111,400	-	-	-
1941	156,200	-	-	-
1942	46,000	-	-	-
1943	90,300	-	-	-
1944	139,100	-	-	-
1945	152,700	-	-	-
1946	217,200	-	-	-
1947	195,300	-	-	-
1948	171,000	-	-	-
1949	35,200	-	-	-
1950	168,500	-	-	-
1951	88,200	1,003	-	-
1952	45,500	445	-	-
1953	32,400	453	-	-
1954	35,322	473	-	-
1955	64,216	794	-	-
1956	170,458	1,326	-	-
1957	118,291	1,479	-	-
1958	88,801	1,069	-	-
1959	107,444	1,294	108	5
1960	77,913	835	-	-
1961	49,465	559	-	-
1962	33,876	379	46	2
1963	31,216	468	199	16
1964	47,904	718	399	80
1965	25,636	360	460	106
1966	19,256	288	662	496
1967	11,227	169	400	488
1968	8,000	81	72	21
1969	13,000	257	5	8
1970	7,400	163	190	95
1971	10,117	269	769	384
1972	14,040	418	600	300
1973	34,804	2,660	306	153

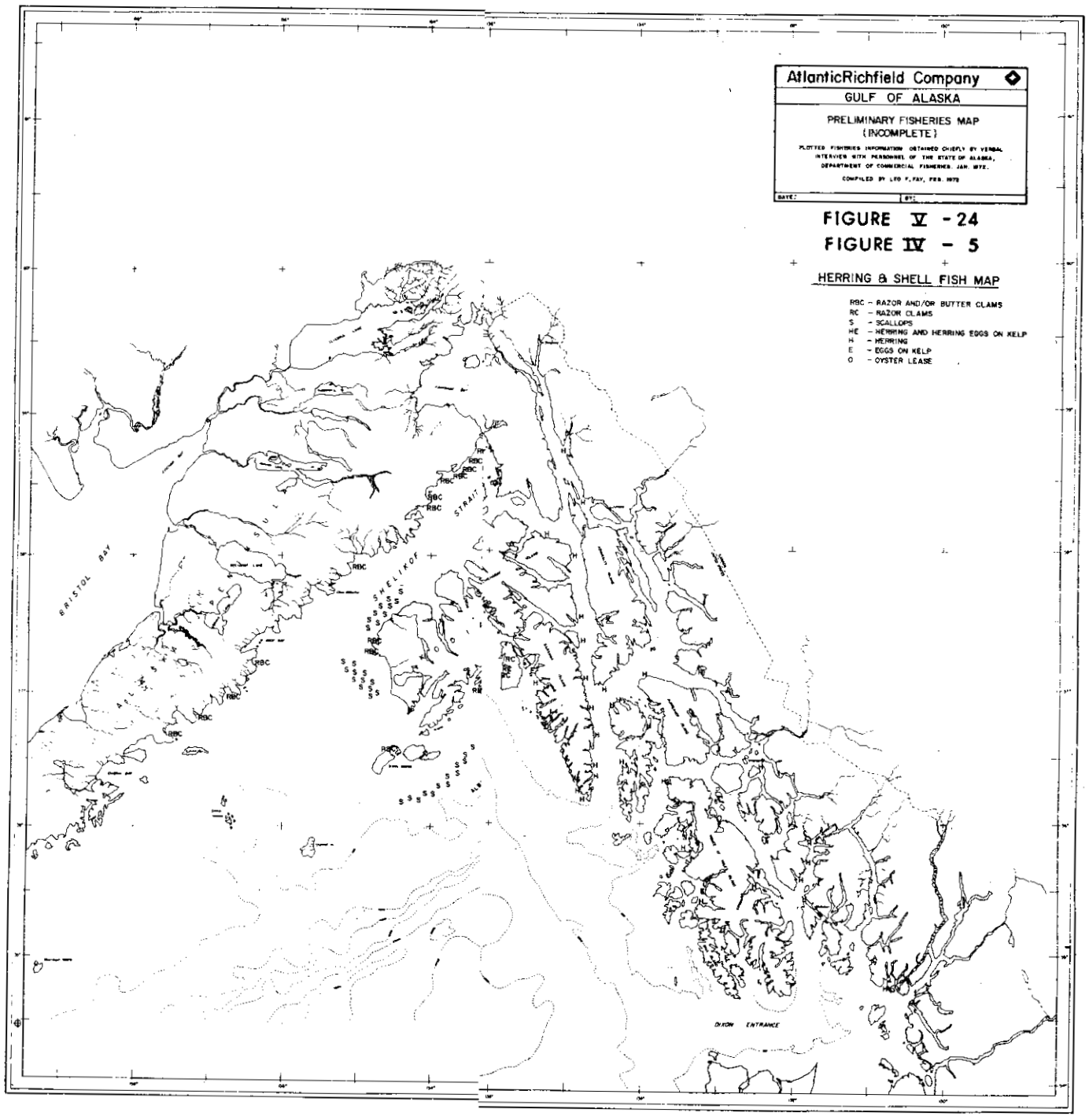
SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.


AtlanticRichfield Company
GULF OF ALASKA
PRELIMINARY FISHERIES MAP
(INCOMPLETE)
PLOTTED FISHERIES INFORMATION OBTAINED CHIEFLY BY VERBAL INTERVIEW WITH PERSONNEL OF THE STATE OF ALASKA, DEPARTMENT OF COMMERCIAL FISHERIES. JAN. 1972.
COMPILED BY LEO F. FAY, FEB. 1972
DATE:
BY:
FIGURE V - 24
FIGURE IV - 5
HERRING & SHELL FISH MAP
RBC - RAZOR AND/OR BUTTER CLAMS
RC - RAZOR CLAMS
S - SCALLOPS
HE - HERRING AND HERRING EGGS ON KELP
H - HERRING
E - EGGS ON KELP
O - OYSTER LEASE
BRISTOL BAY
SHELIKOF STRAIT
DIXON ENTRANCE

VI. THE SALMON RESOURCES

INTRODUCTION:
GENERAL SALMON FISHERY

Juvenile and adult salmon are present in the coastal waters of the Gulf of Alaska from May through September. For the entire coastal area, from Gore Point to Cape Fairweather, the average annual salmon run is about 9.6 million fish (Table VI-1). Approximately 67 percent of this run occurs in Prince William Sound where pink salmon (Onchorhynchus gorbuscha) predominate.

The average annual abundance of juvenile salmon in the coastal region of the Gulf of Alaska is about 660 million, of which 532 million are juvenile pink salmon in Prince William Sound.

The coastal salmon fisheries in the Gulf of Alaska contributed 10 percent of the salmon production for the entire state and had an average (1960-1969) annual wholesale value of $10 million.

Estimates of the future value of the catches to the fishermen are given in Table VI-2. The average annual value for the entire area is about $4.7 million as calculated in this manner. This is about 20 percent higher than the average value for 1960-1969 (Table VI-3). Assuming a 20 percent increase is wholesale value, then the future value of salmon products for the Gulf region is about $12 million [25].

The annual salmon runs are managed, largely through regulation of fishing time, to achieve a biologically sound division between the catch and escapement (spawners). By maintaining adequate escapements in the annual runs of each species and each spawing area, fishery managers hope to maintain production at a reasonably high level. It is generally assumed that a relationship exists between the number of spawners and the number of adult salmon returning in future years.

The distribution and abundance of juvenile salmon is important in itself as well as for the prediction of the magnitude of future adult runs. Unfortunately, the distribution and abundance of juvenile and adult salmon in the coastal region of the Gulf of Alaska are poorly known[25].

TABLE VI-1 - Calculated average salmon run (in thousands of fish), 1960-1969, by species and district.*

DISTRICT	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
Resurrection Bay	1	57	2	78	5	142
Prince William Sound	4	254	76	5,318	796	6,448
Copper River	31	1,661	412	2	1	2,106
Bering River	1	83	150	1	1	233
Yakutat	6	253	333	50	17	659
TOTAL	42	2,308	973	5,447	818	9,588

*Runs calculated from average ratios: Run/catch (Pink 1.50, Chum 1.75, Red, King, and Coho 2.66) in Prince William Sound and the average catch by district in 1960-1969 (22).

TABLE VI-2- Future value of annual salmon catch to fishermen (average catch in numbers x average weight (lbs.) x price per lb.)* in thousands of dollars. (22)

DISTRICT	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
Resurrection Bay	-	40	3	22	2	67
Prince William Sound	12	177	81	1,535	358	2,163
Copper River	84	1,161	436	1	-	1,682
Bering River	1	58	159	-	-	218
Yakutat	12	186	323	15	9	545
TOTAL AREA	109	1,622	1,002	1,573	369	4,675

*1960-1969 average catch and weight, 1970 prices.

TABLE VI-3 - Average catch (lbs.) and value to fisherman for salmon caught in the Gulf of Alaska, 1960-1969, and the percentage of the average for all of Alaska [25].

FISHING DISTRICT	10 YEAR AVERAGE WEIGHT (THOUSANDS OF LBS.)		10 YEAR AVERAGE VALUE (THOUSANDS OF DOLLARS)	
Resurrection Bay	333	0.1%	59	0.1%
Prince William Sound	17,203	6.8%	2,060	5.1%
Copper River	5,209	2.1%	1,158	2.9%
Bering River	636	0.2%	117	0.3%
Yakutat	1,905	0.8%	488	1.2%
TOTAL AREA	25,286	10.0%	3,882	9.6%

The major salmon fisheries in the northern Gulf of Alaska are in Prince William Sound and off the mouth of the Copper River. By comparison, the fisheries in the Resurrection Bay and Yakutat districts are minor.

The commercial fishery season in Prince William Sound runs from mid-July to early August. Sockeye (red) salmon, caught primarily by gill nets in the Eshany and Coghill subdistricts, are the third most abundant of the five species of salmon. The midpoint of the sockeye fishing season is mid-July. Pink and chum salmon, which are first and second in abundance, are caught primarily by fifty-foot purse seiners. The midpoint in fishing season for these species is late July. Catches of king and coho salmon in Prince William Sound are relatively minor.

Tables VI-4 and VI-5 show the salmon harvest by species and district. Figures VI-1 and VI-2 illustrate the fishing districts, and Figure VI-3 shows the principal spawning rivers upon which much of the salmon fishery depends. Figure VI-1a illustrates the principal areas fished for the various salmon species.

TABLE VI-4

Average salmon catch, 1960-1969, by species and district.

DISTRICT	KINGS	REDS	COHOS	PINKS	CHUMS
Resurrection Bay	7	21,392	896	51,955	2,685
Prince William Sound	1,642	95,420	28,750	3,545,168	454,591
Copper River	11,516	624,341	154,760	1,321	246
Bering River	142	31,353	56,301	42	4
Yakutat Bay	2,352	95,197	125,205	33,106	9,923
TOTAL AREA	15,659	867,703	365,912	3,631,592	467,449
TOTAL ALASKA	563,600	13,260,600	1,862,900	29,844,900	5,369,300
Percentage Area of Total Alaska	2.8	6.5	19.6	12.2	8.7

TABLE VI-5

Salmon catches in numbers of fish, 1951-1973.

RESURRECTION BAY DISTRICT

YEAR	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
1951	2	176	13,331	9,031	1,815	24,355
1952	31	7,773	10,822	44,389	5,988	69,003
1953	1	5,090	3,332	3,957	2,978	15,358
1954	0	12,065	2,556	8,552	1,949	25,122
1955	4	5,049	6,160	55,994	3,147	70,354
1956	1	296	3,762	16,738	686	21,483
1957	120	2,876	119	1,275	31	4,421
1958	0	897	5	132,864	141	133,907
1959	60	9,585	5,502	42,665	2,825	60,637
1960	3	11,235	895	59,790	8,945	80,868
1961	2	12,503	285	10,270	1,657	24,717
1962	0	8,440	5,089	137,003	551	151,083
1963	0	1,003	2,253	276	1,492	5,024
1964	0	54	16	24,072	22	24,164
1965	0	1,964	0	26	0	1,990
1966	0	800	118	140,146	4,528	145,592
1967	0	2,502	204	3,168	1,798	7,672
1968	2	76,018	90	144,802	7,846	228,758
1969	3	99,403	6	1	10	99,423
1970						
1971	32	3,824	1,132	119,662	479	125,129
1972	19	26,502	906	18,872	3,177	49,476
1973	6	5,052	805	10,033	40,909	56,805

TABLE VI-5 (CONTINUED)

Salmon catches in numbers of fish, 1951-1973.

YAKUTAT DISTRICT

YEAR	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
1951	1,260	148,295	127,701	35,222	5,328	317,806
1952	2,414	110,358	187,990	37,067	12,599	350,428
1953	1,914	111,733	150,512	8,801	15,605	288,565
1954	2,246	127,095	267,181	40,043	16,094	452,659
1955	3,808	111,250	201,842	25,686	23,568	366,154
1956	6,341	108,303	130,445	17,201	23,533	285,823
1957	3,680	110,504	63,009	16,475	31,996	225,644
1958	1,098	42,090	98,772	61,785	17,764	221,509
1959	1,412	76,790	138,989	12,505	36,694	266,390
1960	916	48,321	121,320	13,966	12,491	197,014
1961	2,534	82,929	130,314	65,063	11,520	292,360
1962	2,748	80,668	189,511	27,692	17,914	318,533
1963	942	52,711	145,863	79,180	10,679	289,375
1964	2,005	92,235	169,806	40,392	5,669	310,107
1965	1,468	122,735	125,421	4,425	4,258	258,307
1966	2,152	185,361	67,414	1,395	3,395	259,717
1967	2,190	88,431	120,286	32,532	4,471	247,910
1968	3,801	80,780	122,497	2,317	13,896	223,291
1969	4,768	117,797	59,623	64,094	14,935	261,217
1970						
1971	10,173	129,212	40,504	80,317	5,019	265,225
1972	5,935	131,487	55,621	3,021	8,318	204,382
1973	4,369	128,285	42,710	17,083	8,996	201,443

TABLE VI-5 (CONTINUED)

Salmon catches in numbers of fish, 1951-1973.

BERING RIVER DISTRICT

YEAR	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
1951	34	3,591	46,306	5	1	49,937
1952	0	0	13,642	0	0	13,642
1953	26	8,572	0	0	0	8,598
1954	0	129	91,964	9	1	92,103
1955	125	34,121	70,100	50	2	104,398
1956	147	41,437	53,484	46	5	95,119
1957	71	29,142	27,441	27	22	56,703
1958	72	23,947	21,202	32	1	45,254
1959	77	27,384	58,560	6	0	86,027
1960	63	32,890	70,065	126	6	103,150
1961	872	60,116	50,883	30	1	111,902
1962	246	72,230	55,502	0	2	127,980
1963	95	23,127	88,610	60	0	111,892
1964	36	13,469	78,708	0	0	92,213
1965	3	10,651	52,114	0	32	62,800
1966	36	24,949	49,818	0	1	74,804
1967	20	11,866	46,138	3	2	58,029
1968	10	26,136	67,134	199	0	93,479
1969	44	38,093	4,033	1	0	42,171
1970						
1971	105	36,776	88,231	4	-	125,116
1972	107	51,445	19,825	3	1	71,381
1973	285	15,426	65,348	2	5	81,066

TABLE VI-5 (CONTINUED)

Salmon catches in numbers of fish, 1951-1973.

COPPER RIVER DISTRICT

YEAR	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
1951	17,439	451,943	154,418	101	48	623,949
1952	29,355	1,136,316	163,740	6,284	1,091	1,336,786
1953	12,198	563,708	29,866	166	46	605,984
1954	15,764	1,099,564	157,941	135	272	1,273,676
1955	20,438	636,705	158,208	149	12	815,512
1956	11,702	540,575	109,248	1,131	54	662,710
1957	8,151	541,637	58,705	1,841	1,224	611,558
1958	6,965	307,342	81,610	8,872	181	404,970
1959	9,833	299,782	132,259	940	67	442,881
1960	8,678	360,667	137,957	375	314	507,991
1961	7,621	528,223	133,987	1,639	106	671,576
1962	14,792	677,626	174,628	1,880	513	869,439
1963	10,871	375,029	202,621	1,487	85	590,093
1964	12,751	699,548	242,666	548	62	955,575
1965	15,390	818,277	70,786	803	331	905,587
1966	11,422	1,005,615	116,147	717	115	1,134,016
1967	9,853	508,327	160,532	573	218	679,503
1968	9,743	573,261	230,867	4,343	473	818,687
1969	14,040	696,836	77,405	847	244	789,372
1970						
1971	16,486	616,801	208,915	1,762	5,287	849,251
1972	22,349	727,144	103,211	2,304	717	855,725
1973	19,948	332,816	132,272	8,964	10,173	504,173

TABLE VI-5 (CONTINUED)

Salmon catches in numbers of fish, 1951-1973.

PRINCE WILLIAM SOUND DISTRICT

YEAR	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
1951	3,636	208,065	47,636	802,892	549,206	1,611,435
1952	111	74,324	51,130	2,161,556	549,663	2,836,784
1953	72	49,252	37,012	1,996,413	352,714	2,435,463
1954*	1	6,185	436	12,142	6,071	24,835
1955*	0	12,924	596	26,873	4,662	45,055
1956	492	156,336	34,850	4,525,408	507,199	5,224,285
1957	968	66,468	20,935	649,001	705,642	1,443,014
1958	12,041	13,821	22,555	6,289,924	687,266	7,025,607
1959*	1,447	0	1,123	229	0	2,799
1960	1,584	35,176	30,722	1,841,899	381,858	2,291,239
1961	406	68,572	10,988	2,298,218	224,401	2,602,585
1962	1,830	54,468	31,908	6,742,316	891,880	7,722,402
1963	2,293	60,304	48,661	5,295,378	942,900	6,349,536
1964	71	66,974	30,969	4,206,896	539,047	4,843,957
1965	1,099	116,092	45,211	2,460,471	201,043	2,823,916
1966	650	99,714	23,908	2,699,418	426,628	3,250,318
1967	3,624	45,515	40,569	2,626,340	274,234	2,990,282
1968	1,523	121,804	11,693	2,452,168	342,939	2,930,127
1969	3,340	285,584	12,866	4,828,579	320,977	5,451,346
1970						
1971	3,551	88,368	30,551	7,310,964	574,265	8,007,699
1972	547	197,526	1,634	54,783	45,370	299,860
1973	2,405	124,802	1,399	2,056,878	729,839	2,915,323

* Fishery closures.

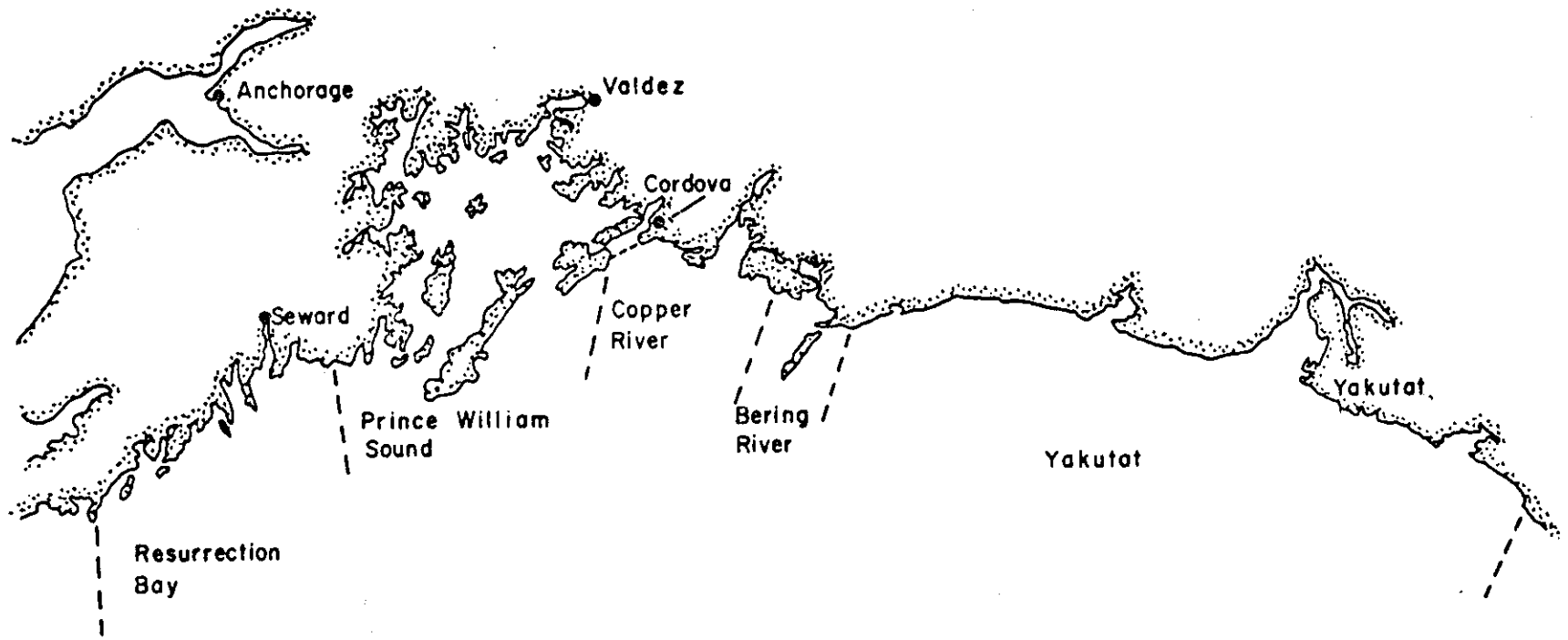


Figure VI-1 Coastal region of upper Gulf of Alaska showing major salmon fishing districts.

AtlanticRichfield Company

GULF OF ALASKA

PRELIMINARY FISHERIES MAP
(INCOMPLETE)

PLOTTED FISHERIES INFORMATION OBTAINED DIRECTLY BY VESSEL INTERVIEW WITH PERSONNEL OF THE STATE OF ALASKA, DEPARTMENT OF COMMERCIAL FISHERIES. JAN. 1972.

COMPILED BY LEO F. FAY, FEB. 1972

DATE: | BY:

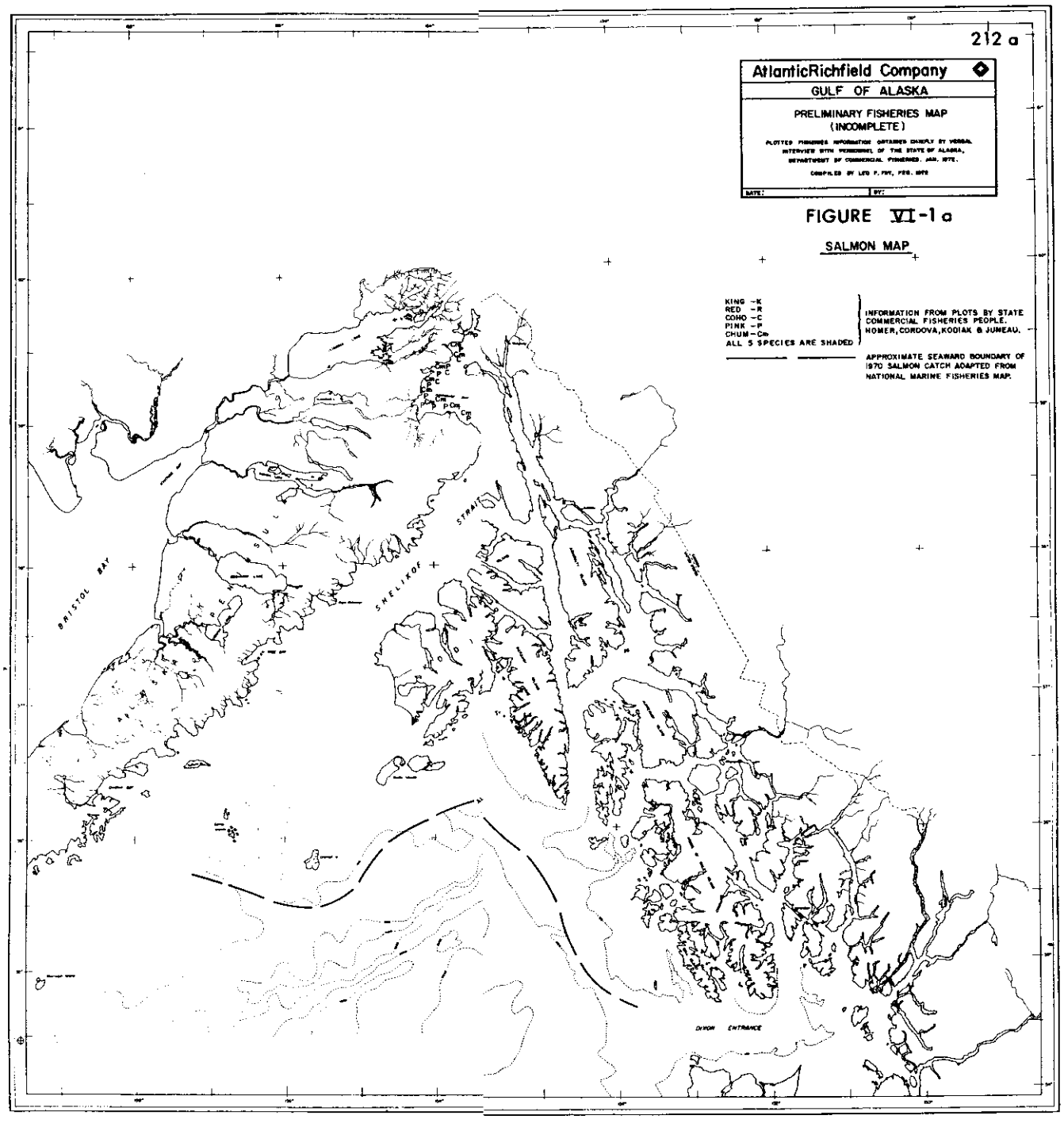
FIGURE VI-1a

SALMON MAP

KING – K
RED – R
COHO – C
PINK – P
CHUM – Chm
ALL 5 SPECIES ARE SHADED

INFORMATION FROM PLOTS BY STATE COMMERCIAL FISHERIES PEOPLE. HOMER, CORDOVA, KODIAK & JUNEAU.

APPROXIMATE SEAWARD BOUNDARY OF 1970 SALMON CATCH ADAPTED FROM NATIONAL MARINE FISHERIES MAP.



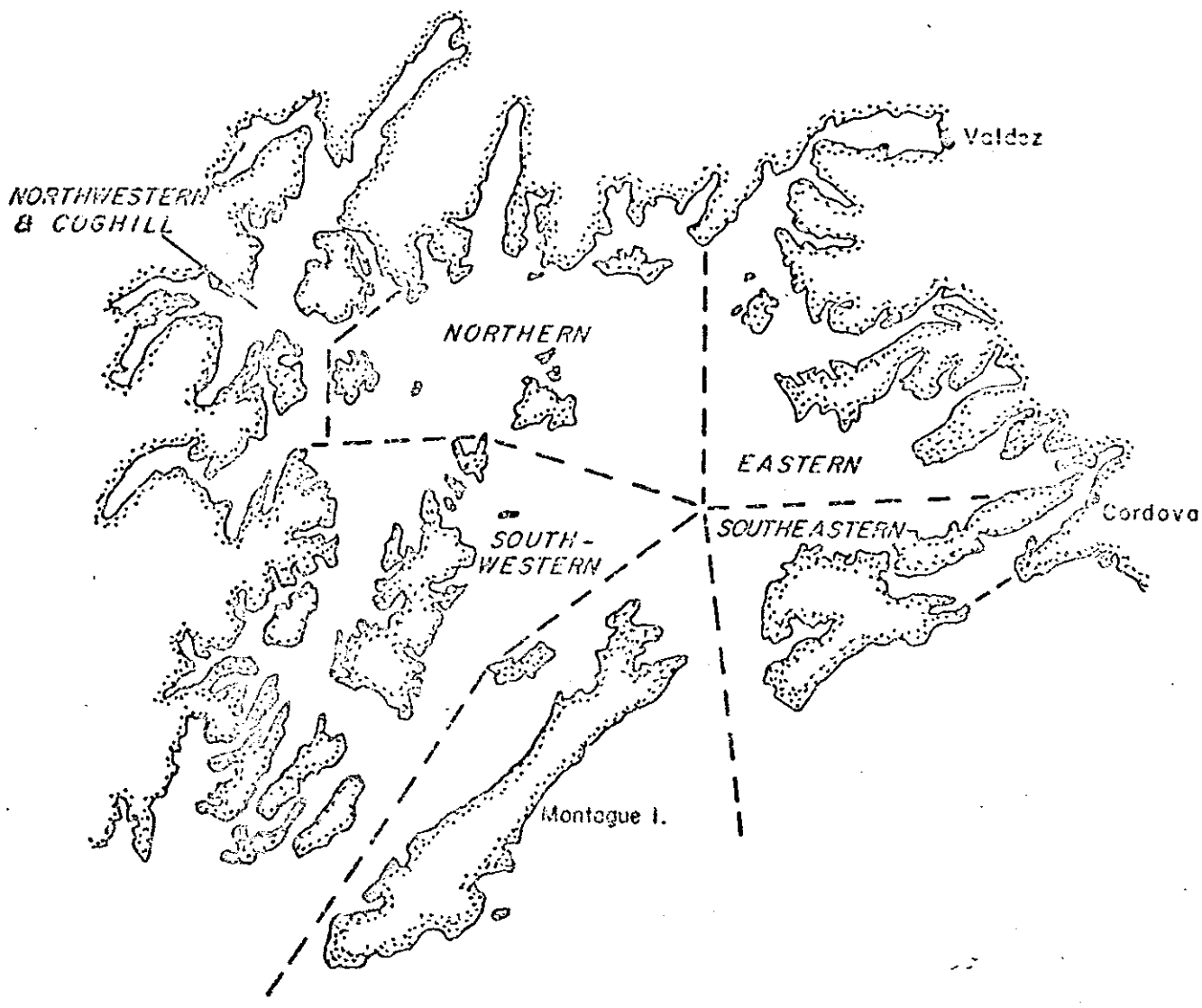


Figure VI-2 Fishery management districts in Prince William Sound.

JUVENILE SALMON

The relative abundance and distribution of juvenile salmon in the coastal region of the Gulf of Alaska can be assumed to roughly parallel the distribution of adult spawners. With the exception of juvenile pink salmon in the Prince William Sound, little is known concerning the timing of migration, distribution, abundance or size of juvenile salmon in the Gulf. All species of salmon migrate to sea in the spring or early summer. At the time of migration into the estuaries, pink and chum salmon are the smallest (30-40 mm), while coho and red salmon are the largest (about 100 mm). Survey data indicate that young pink salmon are in the estuaries from May through June with a peak in abundance in late May. Juvenile pink salmon probably move out of the estuaries and into the open water of Prince William Sound in July and are in the North Pacific by September. It seems quite likely that juvenile salmon are in the coastal waters of the Gulf from early May to early September[25].

Fishing Gear

Salmon fishing in North American waters occurs primarily along the coast. Most fish are taken by trawling, gill nets, and seiners. Trawling lines, employing four or more lines attached to long trawling poles may range from 100-150 fathoms in length.

Purse seines require two boats, handling a seine some 200-300 fathoms long, 20-40 fathoms deep at the ends and 25-80 fathoms deep at the center.

Gill net vessels typically range from 22-40 feet in length. Net lengths in North American waters range from 100-300 fathoms.

The number of purse seine vessels fishing in Prince William Sound varied between 102 and 248 over the years 1961-1969. In 1970, there were 245 purse seiners fishing during the peak of the season and about 150 gill net boats.

In the Copper and Bering River districts, the amount of fishing gear is greatest during the early-season red salmon fishery. In 1970, approximately 450 gill-net boats (32-foot limit) fished during the red salmon season, while 350 boats fished in the coho season. About 83 percent of this gear was fished in the Copper River district.

The salmon fishing season in the Copper and Bering River districts runs from mid-May to mid-September. Drift gill nets (5 1/2-inch mesh) are the only gear employed in these districts. In the Copper River district, red salmon are taken from mid-may to early August, with coho predominating the catches from late July to mid-September. The peak in the red salmon fishery usually occurs in the last half of May, whereas the coho catches peak in the last half of August[25].

In the Bering River district, red salmon catches peak in late June, and coho catches peak in early September. The small commercial fishery in Resurrection Bay is by beach seine, and red salmon predominate in the catches in June, while pink salmon are most abundant in July. In recent years, the commercial fishery has been closed by early August. A sport fishery for coho salmon takes place in August. Set gill nets and troll lines are used in the Yakutat district.

Processing

Red, pink and chum salmon are primarily processed by canning, and in 1970 there were five companies canning salmon in the Cordova area. In 1969 there were nine companies doing this in the Cordova-Valdez areas. Catches of king and coho salmon are primarily processed as fresh, frozen or cured. In 1970 two companies in Cordova and one in Seward processed frozen fish, while in 1969 three companies in Cordova and one in Valdez had processed salmon in this manner (25).

CHINOOK (KING) SALMON

In the north Pacific Ocean Chinook salmon (Oncorhynchus tshawytscha) are found generally to the north of 46°NL in the eastern half of the ocean. Although chinook spawn in the Sacramento-San Joaquin system California, they are rarely found in streams south of San Francisco Bay. Spawning occurs in rivers north to the Bering Sea.

Chinook generally ascend the larger streams to spawn and are abundant in such rivers as the Sacramento, Columbia, Fraser, and Yukon. The center of abundance of this species is the Columbia River, in which adults return to spawn during every month of the year. Here the principal runs are designated as the spring, summer, and fall run. The fall chinook run, which usually spawns in the tributaries of the lower Columbia are not known to make a significant contribution to the Alaska fishery. However, winter, spring, summer and upper-river fall run chinook stocks migrate further north in great numbers and indications are that many move offshore to feed in the Gulf of Alaska. Also, about 75 percent of the ocean catch from Oregon coastal streams probably occurs off British Columbia and southeastern Alaska. The Fraser River in British Columbia is another major contributor to the fisheries of the Gulf of Alaska and southeastern Alaska. In British Columbia and Alaska, chinook salmon generally enter the streams from May to July.

Chinook salmon occur in Alaska from Dixon Entrance to the Yukon River. Age at maturity varies from three to seven years, and full grown chinooks average about 23 pounds, although occasionally they have been found to weigh as much as 100 pounds. Chinook are usually the first species to enter the commercial fisheries annually in each of the several districts, usually migrating into the larger rivers.

Gulf of Alaska catch data are shown in Tables VI-6 and VI-11, and Figure VI-4.

Table VI-6

GULF OF ALASKA
SALMON LANDINGS BY SPECIES AND REGION
1935-1973
CHINOOK (KING)
Millions of Pounds & Millions of Dollars

	SOUTHESTERN		CENTRAL		TOTAL	
Year	Quantity	Value*	Quantity	Value*	Quantity	Value*
1935	13.0	-	1.8	-	14.8	-
1936	14.0	-	2.0	-	16.0	-
1937	17.3	-	2.4	-	19.7	-
1938	14.7	-	1.5	-	16.2	-
1939	14.0	-	1.8	-	15.8	-
1940	8.9	-	1.5	-	10.4	-
1941	13.1	-	2.5	-	15.6	-
1942	11.7	-	2.6	-	14.3	-
1943	8.6	-	2.9	-	11.5	-
1944	6.6	-	2.1	-	8.7	-
1945	8.4	-	2.3	-	10.7	-
1946	12.4	-	2.0	-	14.4	-
1947	11.6	-	2.8	-	14.4	-
1948	10.2	-	2.7	-	12.9	-
1949	10.3	-	2.7	-	13.0	-
1950	8.3	-	3.1	-	11.4	-
1952	9.2	-	5.4	-	14.6	-
1952	8.4	-	2.6	-	11.0	-
1953	10.0	-	2.6	-	12.6	-
1954	8.0	-	2.1	-	11.0	-
1955	7.2	-	1.8	-	9.0	-
1956	5.3	-	1.7	-	7.0	-
1957	4.1	-	1.3	-	5.4	-
1958	6.5	2.2	1.0	.2	7.5	2.4
1959	7.2	2.1	1.0	.2	8.2	2.3
1960	5.0	1.7	.8	.2	5.8	1.9
1961	3.0	1.3	.6	.1	3.6	1.4
1962	3.8	1.8	.9	.2	4.7	2.0
1963	4.5	2.2	.7	.2	5.2	2.4
1964	6.6	2.8	.5	.1	7.1	2.9
1965	5.4	1.9	.7	.1	6.1	2.0
1966	4.7	2.0	.6	.1	5.2	2.1
1967	4.5	1.8	.5	.2	5.0	2.0
1968	5.3	2.3	.5	.1	5.8	2.4
1969	4.2	2.0	.7	.2	4.9	2.2
1970	4.6	3.6	.9	.3	5.6	3.9
1971	4.5	2.9	1.0	.4	5.5	3.3
1972	3.4	2.2	1.1	.5	4.5	2.7
1973	4.7	5.2	.9	1.7	5.6	6.9

Figures for the years 1935-1957 inclusive, have been revised to maintain consistency in the method of reporting, therefore, value figures from original data within this period are excluded.

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

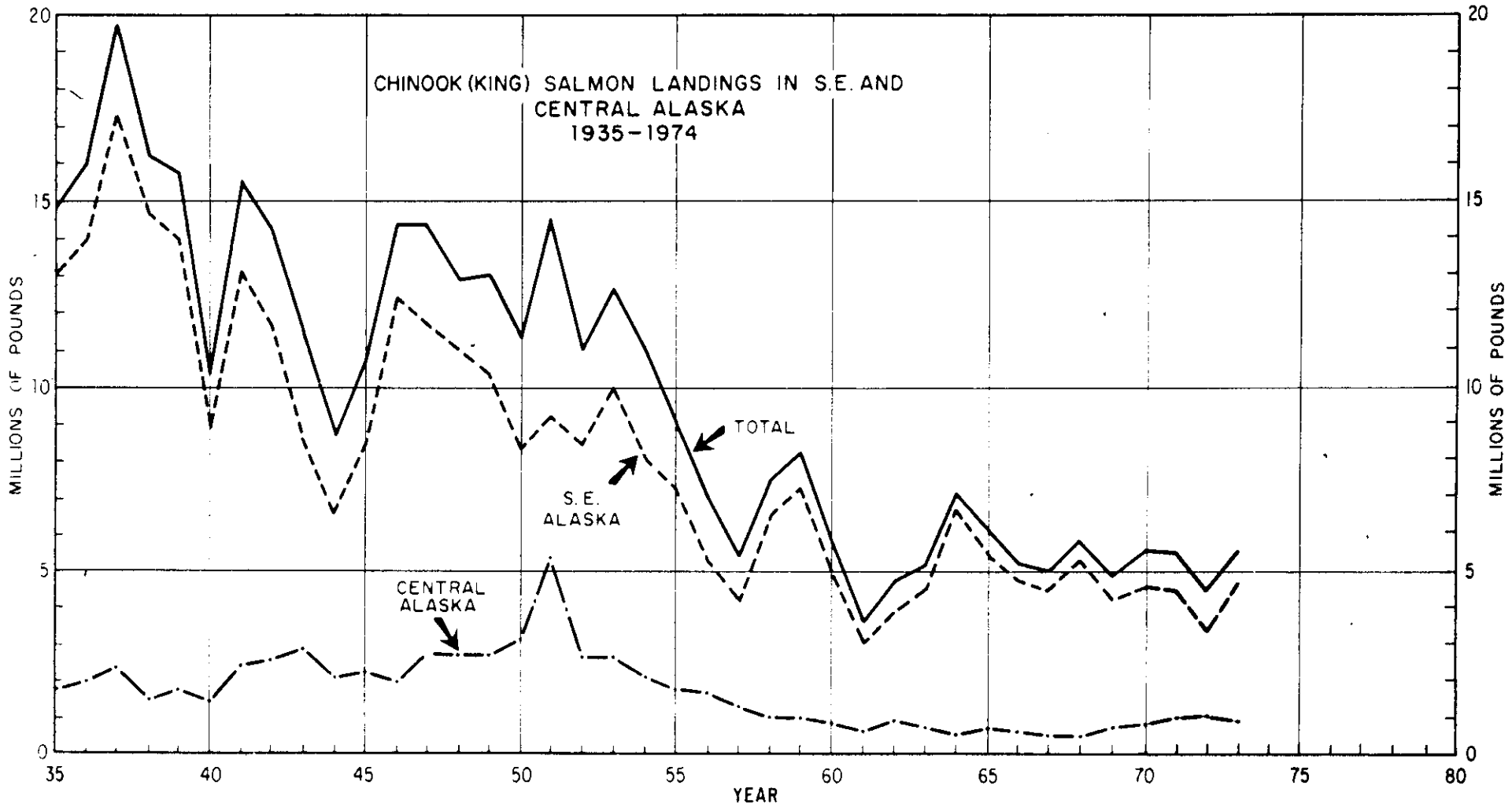

CHINOOK (KING) SALMON LANDINGS IN S.E. AND CENTRAL ALASKA
1935–1974
MILLIONS OF POUNDS
MILLIONS OF POUNDS
YEAR
TOTAL
S.E. ALASKA
CENTRAL ALASKA
0
5
10
15
20
35
40
45
50
55
60
65
70
75
80

Figure VI-4

PINK (HUMPBACKED) SALMON

Pink or humpbacked salmon (Oncorhynchus gorbuscha) are the most abundant of the Pacific salmon in Alaska. The species occurs in streams from California to the Arctic Ocean on the North American side of the Pacific Ocean. Their oceanic distribution extends from North American to Asia north of the fortieth parallel through the Bering Strait into the Arctic Ocean. Pugent Sound is the southern limit and Bristol Bay the northern limit of commercially important runs in North America. Alaska produces more than half of the North American total, with southeastern Alaska producing about half of Alaska's total catch. Other important pink salmon producing areas are Prince William Sound, Cook Inlet, Kodiak Island, and the south side of the Alaska Peninsula.

This species has the shortest life history of any Pacific salmon, spending one year at sea, with a total two year life cycle.

In Alaska, pink salmon typically spawn in the lower reaches of short coastal streams, although many use the intertidal areas of these streams where the eggs are alternately washed by fresh and brackish waters. For example, in Prince William Sound, between 50 and 75 percent of the pink salmon fry are produced in intertidal zones.

Spawning occurs in late summer, early fall (August or September when stream temperatures are about 50°F), with eggs hatching in midwinter. The fry emerge in the spring (April or May) and migrate directly to sea.

Pink and chum salmon have similar spawning requirements. The young of both species migrate to salt water in the spring shortly after emergence from the gravel. The spawning of these species is typically in small coastal streams and often occurs in the intertidal region of the stream. During the

first few days in the estuary schools are formed near the surface of the water and migration occurs along the shore. At this stage they move with surface currents and are carried out of the estuary into the ocean in a few days to several weeks.

Adult pink salmon are two years old, whereas adult chum salmon are 3, 4, or 5 years old. For the entire Gulf area, pink and chum salmon spawning is concentrated in Prince William Sound where over 300 streams contain important spawning populations. Time of peak spawning varies from late July to early September depending on the spawning stock. There are at least two major pink salmon spawning grounds in the Yakutat district and some chum salmon spawning in Resurrection Bay, otherwise pink and chum salmon spawning is light in the Gulf outside of Prince William Sound.

Most pink salmon are taken in coastal waters by purse seiners, but a small percentage of the commercial catch is taken by gill nets.

In addition to the commercial aspects of the pink salmon fishery, Indians and Eskimos along the Arctic coast take thousands in traps and gill nets for subsistence[25].

Gulf of Alaska pink salmon harvest data are shown in Tables VI-7 and VI-11 and Figure VI-5.

Table VI-7

GULF OF ALASKA
SALMON LANDINGS BY SPECIES AND REGION
1935-1973
PINK
Millions of Pounds & Millions of Dollars

	SOUTHEASTERN		CENTRAL		TOTAL	
Year	Quantity	Value*	Quantity	Value*	Quantity	Value*
1935	162.8	-	77.3	-	240.1	-
1936	216.8	-	118.8	-	335.6	-
1937	158.6	-	109.7	-	268.3	-
1938	139.9	-	99.7	-	239.6	-
1939	109.6	-	78.3	-	187.9	-
1940	108.3	-	107.2	-	215.5	-
1941	270.1	-	75.1	-	345.2	-
1942	129.9	-	77.8	-	207.7	-
1943	77.0	-	93.9	-	170.9	-
1944	81.1	-	74.2	-	155.3	-
1945	77.8	-	88.6	-	166.4	-
1946	74.4	-	77.6	-	152.0	-
1947	50.7	-	77.2	-	127.9	-
1948	51.0	-	45.8	-	96.8	-
1949	157.4	-	42.9	-	200.3	-
1950	40.0	-	41.3	-	81.3	-
1951	91.2	-	24.7	-	115.9	-
1952	44.0	-	43.0	-	87.0	-
1953	25.9	-	45.1	-	71.0	-
1954	38.7	-	46.2	-	84.9	-
1955	40.3	-	54.1	-	94.4	-
1956	46.9	-	41.0	-	87.9	-
1957	30.6	-	25.0	-	55.6	-
1958	52.6	4.6	60.0	5.9	112.6	10.5
1959	35.8	3.8	12.2	1.1	48.0	4.9
1960	10.5	1.3	39.2	5.2	49.7	6.5
1961	63.9	6.3	39.1	3.7	103.0	10.0
1962	45.7	5.6	88.4	13.7	134.1	19.3
1963	70.1	8.3	54.6	6.1	124.7	14.4
1964	71.5	7.7	85.5	8.9	157.0	16.6
1965	42.5	4.4	32.4	3.3	74.9	7.7
1966	89.9	13.4	64.9	7.8	154.8	21.2
1967	14.0	1.7	14.7	1.5	28.7	3.2
1968	82.8	12.4	56.0	6.7	138.8	19.1
1969	20.5	3.4	84.3	12.2	104.8	15.6
1970	41.4	5.4	71.9	9.6	113.3	15.0
1971	34.4	5.2	51.7	8.2	86.1	13.4
1972	38.5	6.9	20.9	3.8	59.4	10.7
1973	23.4	6.4	12.9	5.2	36.3	11.6

**Figures for the years 1935-1957 inclusive, have been revised to maintain consistency in method of reporting, therefore, value figures from original data within this period are excluded.*

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

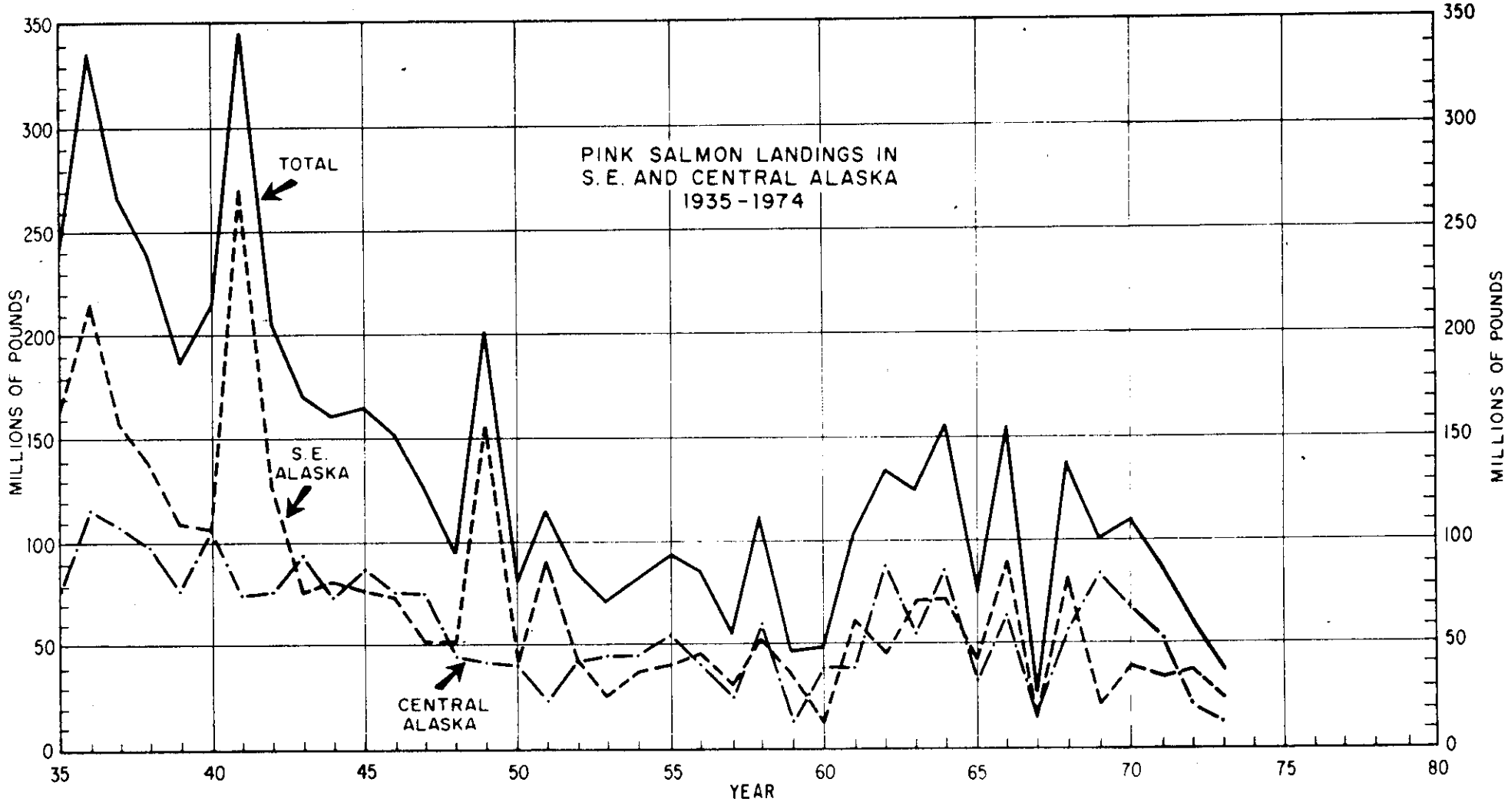

PINK SALMON LANDINGS IN
S.E. AND CENTRAL ALASKA
1935-1974
TOTAL
S.E.
ALASKA
CENTRAL
ALASKA
MILLIONS OF POUNDS
MILLIONS OF POUNDS
YEAR
0
50
100
150
200
250
300
350
35
40
45
50
55
60
65
70
75
80

Figure VI-5

CHUM (DOG) SALMON

Chum salmon (Oncorhynchus keta) are the most widely distributed of the five Pacific salmon species and the second most abundant. In Alaska, chum salmon are numerous in streams in the southeastern panhandle and Cook Inlet. However, the fishery is largely related to the large Arctic tributaries of the Bering and Chukchi Seas of northern Alaska. Mature chums grow rapidly in the ocean, and return to spawn in the streams where they were hatched after 2 - 4 years at sea. The range in age and size at spawning is substantial, running from 3 to 6 years and 5 to 45 pounds, with an average weight in the commercial catch of 8 pounds. Runs begin in midsummer and continue in to fall.

Chum eggs hatch during the winter, but the young do not emerge from the gravel until March, April, or May. Laboratory studies have demonstrated that this requires a constant temperature of 50°F for about 50 days. The species remains in estuarine zones through May and June and enter inshore coastal waters from July to September of their first year.

The central north Pacific is an important feeding area for mature chum salmon from western Alaska and much of Asia.

Chum eggs, larger and brighter than those of other salmon, are particularly desirable for cavier or fish bait. In 1968 the value of egg products from all species of salmon in Alaska was about 12 million dollars. The value of canned chum salmon was 28 million. Most of the chum salmon for the canning and egg industries are taken in purse seines, although a few are taken in drift gill nets. The commercial salmon fishing season varies in different sections of Alaska year to year but generally is from July to October.

Most chum salmon are taken in purse seines for canning. Several hundred thousand are taken in gill nets and fish wheels for subsistence consumption by the native Alaskans[25].

Gulf of Alaska chum salmon harvest data are shown in Tables VI-8 and VI-11, and Figure VI-6.

Table VI-8

GULF OF ALASKA
SALMON LANDINGS BY SPECIES AND REGION
1935-1973
CHUM (KETA)
Millions of Pounds & Millions of Dollars

	SOUTHEASTERN		CENTRAL		TOTAL	
Year	Quantity	Value*	Quantity	Value*	Quantity	Value*
1935	39.6	-	21.8	-	61.4	-
1936	57.9	-	21.3	-	79.2	-
1937	37.8	-	13.8	-	51.6	-
1938	36.7	-	18.2	-	54.9	-
1939	22.1	-	17.2	-	39.3	-
1940	35.7	-	25.4	-	61.1	-
1941	23.1	-	24.1	-	47.2	-
1942	44.2	-	23.7	-	67.9	-
1943	52.1	-	14.2	-	66.3	-
1944	53.7	-	20.6	-	74.3	-
1945	25.4	-	24.1	-	49.5	-
1946	31.2	-	18.4	-	49.6	-
1947	19.9	-	14.6	-	34.5	-
1948	30.2	-	22.0	-	52.2	-
1949	18.9	-	15.9	-	34.8	-
1950	37.7	-	17.5	-	55.2	-
1951	35.8	-	16.4	-	52.2	-
1952	39.3	-	28.9	-	68.2	-
1953	31.1	-	24.1	-	55.2	-
1954	43.9	-	27.8	-	71.7	-
1955	13.0	-	11.9	-	24.9	-
1956	22.4	-	27.4	-	49.8	-
1957	28.3	-	31.8	-	60.1	-
1958	30.1	2.2	26.7	1.7	56.8	3.9
1959	12.6	1.0	14.1	1.0	26.7	2.0
1960	10.2	1.0	24.9	2.0	35.1	3.0
1961	23.1	2.1	16.2	1.2	39.3	3.3
1962	19.5	1.8	30.5	2.5	50.0	4.3
1963	12.6	1.2	18.8	1.5	31.4	2.7
1964	19.5	1.6	34.7	2.5	54.2	4.1
1965	15.0	1.4	12.4	0.8	27.4	2.2
1966	28.1	3.5	19.5	1.8	47.6	5.3
1967	17.4	1.9	9.6	.8	27.0	2.7
1968	28.8	4.0	23.0	2.5	51.8	6.5
1969	5.2	1.0	12.5	1.4	17.7	2.4
1970	20.5	2.8	24.7	2.8	45.2	5.6
1971	16.1	2.5	29.3	3.9	45.4	6.4
1972	26.8	6.1	28.7	4.8	55.5	10.9
1973	17.7	9.2	18.0	6.4	35.7	15.6

Figures for the years 1935-1957 inclusive, have been revised to maintain consistency in the method of reporting, therefore, value figures from original data within this period are excluded.

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

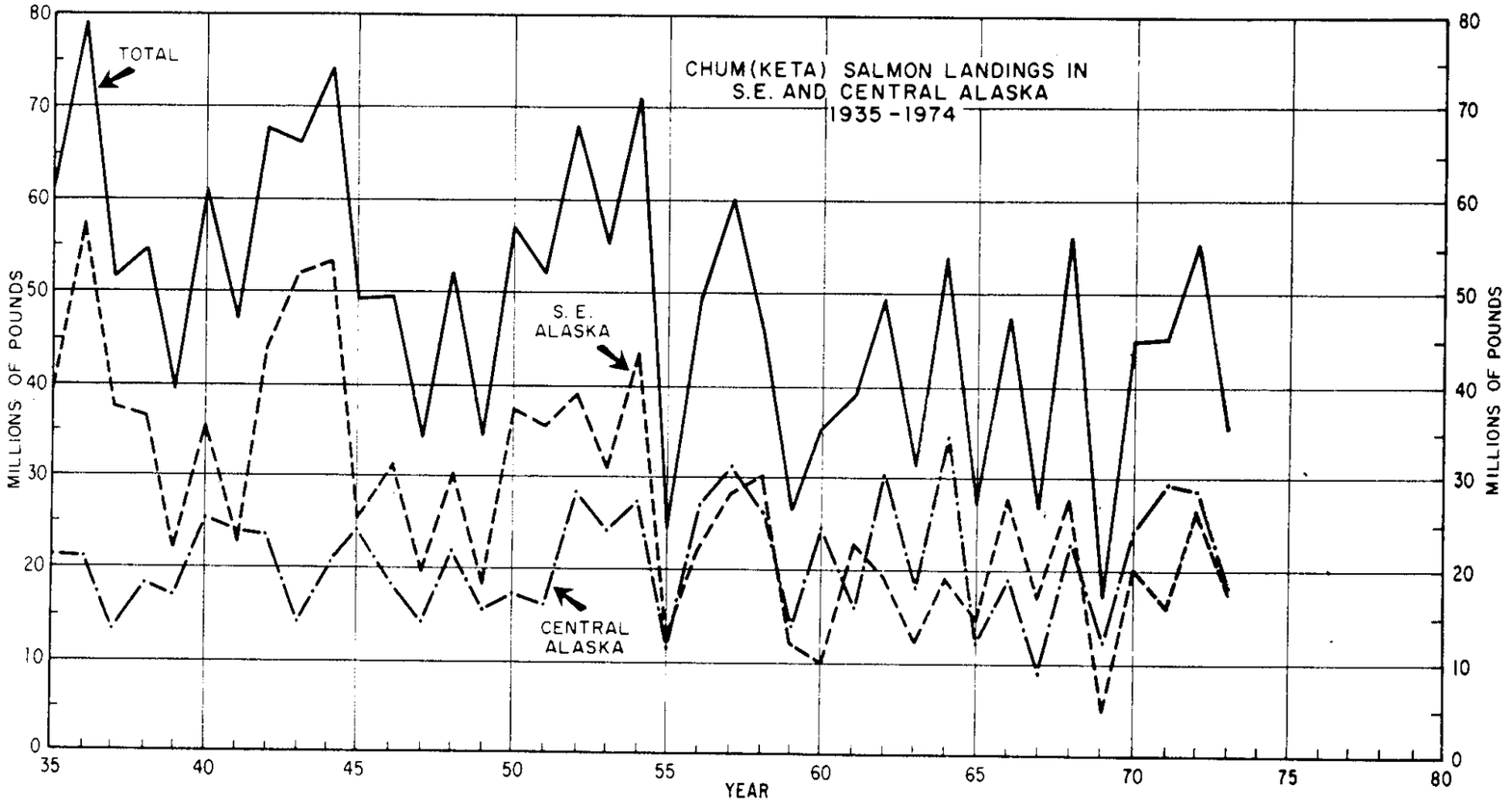

CHUM(KETA) SALMON LANDINGS IN
S.E. AND CENTRAL ALASKA
1935 - 1974
TOTAL
S. E.
ALASKA
CENTRAL
ALASKA
MILLIONS OF POUNDS
YEAR
0
10
20
30
40
50
60
70
80
35
40
45
50
55
60
65
70
75
80

Figure VI-6

RED (SOCKEYE) SALMON

The sockeye or red salmon (Oncorhynchus nerka) is of prime economic importance to the State of Alaska. The species is produced in river-lake systems in Canada, Alaska, and the Soviet Union. The most important system in Alaska is the Bristol Bay complex, which produces an annual catch almost as large as the average yearly catch of 7 other significant systems combined.

Sockeye salmon range from southeastern Alaska waters to the Kuskokwin River. Bristol Bay is the greatest producing area of this species in the world. Reds range from 15 to 20 inches in length and average 6 pounds. The common age at spawning is 5 years but there are sizable proportions of 4 and 6 year olds in the runs. Runs usually begin late in June and continue through July, although the Karluk and Chignik Rivers have two runs, one in June and again in August.

Spawning is typically in streams which are tributaries to lakes or on the beaches of lakes. Juvenile sockeye spend up to three years in a lake prior to seaward migration. Major spawning grounds for sockeye are in the upper Copper River system, around Bering Lake, in the Gulf of Alaska region, and in small river systems which flow into College Fiord and Knight Island Passage in Prince William Sound. There are minor sockeye spawning grounds in other areas of Prince William Sound, in the headwaters of Resurrection Bay, and in some coastal rivers in the Yakutat district.

Sockeye salmon spend most of their life in fresh water, with adults spawning in late summer and autumn in the inlet and outlet rivers of lakes and in the lakes themselves. In Alaska, the spawning season for sockeye salmon extends from late July to early October depending on the location.

In most systems the amount of spawning in lakes is considerably less than in streams, but spawning is extensive in some years in Karluk Lake on Kodiak Island.

In the north Pacific sockeye feed heavily on amphipods, copepods, euphausiids, pteropods, fish, and squid.

The species is extremely important to the American inshore gill net fishery and the Alaska native subsistence fishery in lakes and rivers[25].

Gulf of Alaska sockeye harvest data are shown in Tables VI-9 and VI-11 and Figure VI-7.

Table VI-9
GULF OF ALASKA
SALMON LANDINGS BY SPECIES AND REGION
1935-1973
RED (SOCKEYE)
Millions of Pounds & Millions of Dollars

	SOUTHEASTERN		CENTRAL		TOTAL	
Year	Quantity	Value*	Quantity	Value*	Quantity	Value*
1935	11.6	-	28.0	-	39.6	-
1936	15.7	-	61.9	-	77.6	-
1937	12.1	-	33.7	-	45.8	-
1938	14.2	-	35.0	-	49.2	-
1939	14.9	-	47.5	-	62.4	-
1940	9.0	-	28.0	-	37.0	-
1941	9.9	-	30.0	-	39.9	-
1942	8.5	-	25.8	-	34.3	-
1943	6.1	-	42.3	-	48.4	-
1944	10.3	-	33.3	-	43.6	-
1945	9.8	-	31.9	-	41.7	-
1946	4.8	-	25.2	-	30.0	-
1947	4.0	-	34.3	-	38.3	-
1948	2.9	-	23.3	-	26.2	-
1949	2.8	-	28.5	-	31.3	-
1950	3.5	-	37.2	-	40.7	-
1951	5.1	-	26.2	-	31.3	-
1952	5.4	-	27.2	-	32.6	-
1953	9.1	-	25.5	-	34.6	-
1954	8.2	-	21.9	-	30.1	-
1955	4.0	-	16.8	-	20.8	-
1956	5.8	-	25.7	-	31.5	-
1957	5.9	-	13.6	-	19.5	-
1958	6.0	1.4	9.0	2.0	15.0	3.4
1959	4.5	1.2	10.1	2.3	14.6	3.5
1960	3.2	.8	15.3	3.6	18.5	4.4
1961	4.8	1.2	18.1	4.0	22.9	5.2
1962	4.9	1.3	20.1	4.6	25.0	5.9
1963	3.9	1.1	13.8	3.2	17.7	4.3
1964	5.5	1.6	18.2	4.3	23.7	5.9
1965	6.6	1.8	24.0	5.5	30.6	7.3
1966	7.2	2.3	27.3	6.7	34.5	9.0
1967	6.1	2.6	18.8	0.6	24.9	3.2
1968	5.8	1.7	25.8	6.7	31.6	8.4
1969	4.7	1.7	23.4	5.9	28.1	7.6
1970	4.2	1.3	37.5	9.8	41.7	11.1
1971	3.9	1.4	23.8	6.0	27.7	7.4
1972	5.7	2.2	20.5	6.7	26.2	8.9
1973	7.0	4.6	19.0	7.5	26.0	12.1

**Figures for the years 1935-1957 inclusive, have been revised to maintain consistency in the method of reporting, therefore, value figures from original data within this period are excluded.*

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

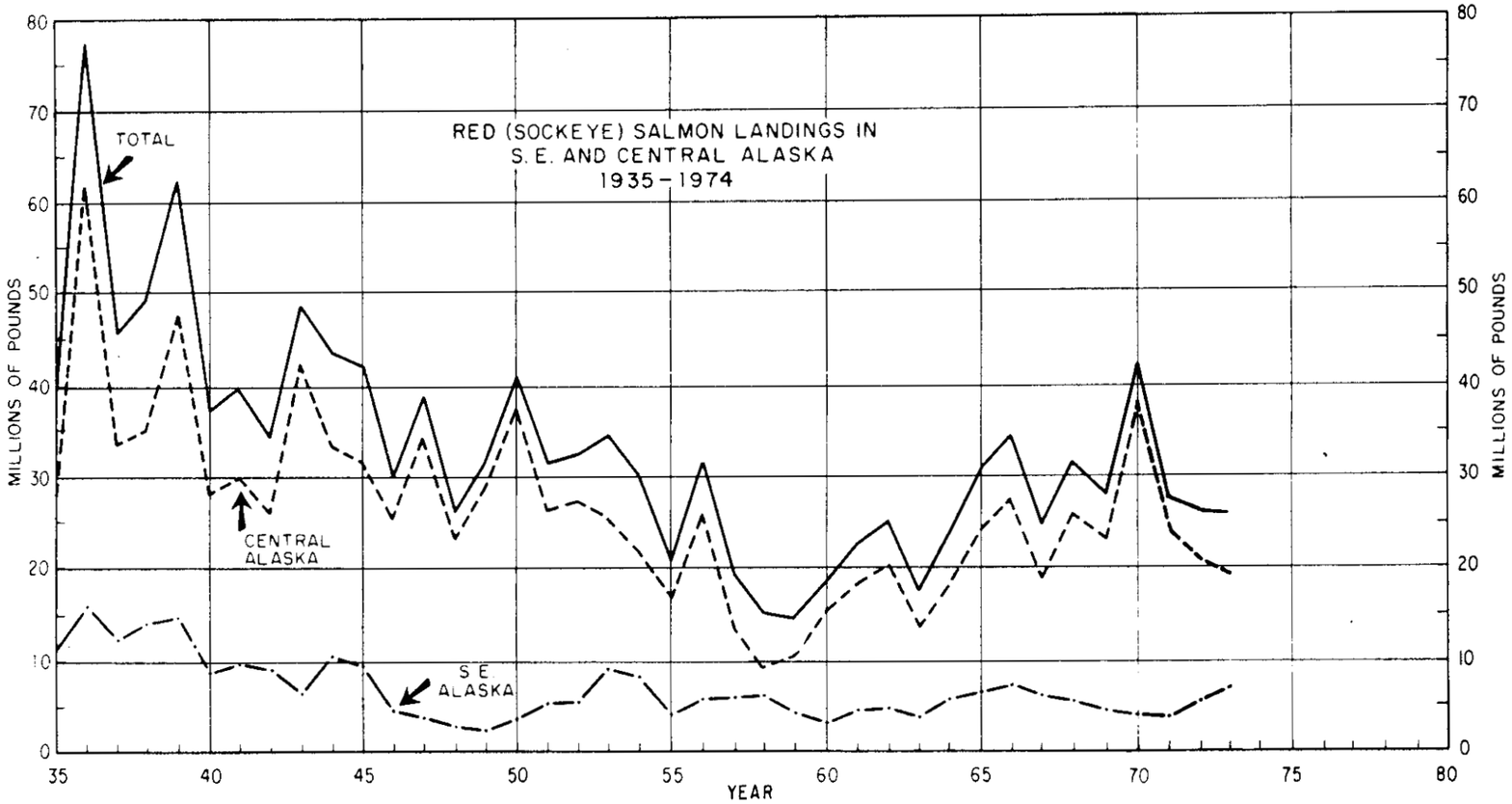

RED (SOCKEYE) SALMON LANDINGS IN
S. E. AND CENTRAL ALASKA
1935 – 1974
TOTAL
CENTRAL ALASKA
S E ALASKA
MILLIONS OF POUNDS
YEAR
0
10
20
30
40
50
60
70
80
35
40
45
50
55
60
65
70
75
80

Figure VI-7

COHO (SILVER) SALMON

Coho salmon (Oncorhynchus kisutch) are almost universally distributed from Dixon Entrance to Kotzebue Sound. Maturity is reached at about 3 years in Alaska waters, with adults averaging about 24 inches in length and 9 pounds in weight.

Coho salmon usually spawn in streams that are tributaries of large rivers or lakes, beginning the fresh water migration between September and December. The species enters the larger rivers, but also is common in the very small coastal streams throughout its range. Spawning often takes place in tiny tributaries only 3 or 4 feet wide. Coho fry emerge from the gravel in the early spring and usually remain in fresh water for about a year before the downstream migration to the sea. In Alaskan streams coho commonly remain in fresh water for two years, entering saltwater by the end of July in their second summer. Feeding is largely on crustaceans and small fish. Adult coho feed principally on squid, small fish, and euphausiids.

The major coho spawning grounds are in the Klutina River watershed (Copper River Basin), four coastal rivers in the Yakutat district, and the headwaters of Resurrection Bay. Numerous small spawning populations are found in Prince William Sound[25].

Gulf of Alaska Coho harvest data are shown in Tables VI-10 and VI-11, and Figure VI-8.

Table VI-10
GULF OF ALASKA
SALMON LANDINGS BY SPECIES AND REGION
1935-1973
SILVER (COHO)
Millions of Pounds & Millions of Dollars

	SOUTHEASTERN		CENTRAL		TOTAL	
Year	Quantity	Value*	Quantity	Value*	Quantity	Value*
1935	14.6	-	3.7	-	18.3	-
1936	16.7	-	6.5	-	23.2	-
1937	10.9	-	3.6	-	14.5	-
1938	20.0	-	5.9	-	25.9	-
1939	9.9	-	2.9	-	12.8	-
1940	19.5	-	8.9	-	28.4	-
1941	14.2	-	11.8	-	26.0	-
1942	19.0	-	13.2	-	32.2	-
1943	15.0	-	5.5	-	20.5	-
1944	14.1	-	7.0	-	21.1	-
1945	25.8	-	7.2	-	33.0	-
1946	19.0	-	7.5	-	26.5	-
1947	13.4	-	6.0	-	19.4	-
1948	18.9	-	5.6	-	24.5	-
1949	18.7	-	4.9	-	23.6	-
1950	14.7	-	7.8	-	22.5	-
1951	26.7	-	5.2	-	31.9	-
1952	13.3	-	5.0	-	18.3	-
1953	11.2	-	2.7	-	13.9	-
1954	18.0	-	5.7	-	23.7	-
1955	10.3	-	3.5	-	13.8	-
1956	8.9	-	3.5	-	12.4	-
1957	8.1	-	2.2	-	10.3	-
1958	8.6	1.6	3.2	.5	11.8	2.1
1959	8.6	2.0	2.6	.3	11.2	2.3
1960	5.3	1.5	3.8	.7	9.1	2.2
1961	7.8	1.5	2.9	.4	10.7	1.9
1962	9.6	2.3	4.9	.8	14.5	3.1
1963	11.3	2.1	5.4	.8	16.7	2.9
1964	12.8	2.4	7.5	1.1	20.3	3.5
1965	13.6	3.9	3.7	.4	17.3	4.3
1966	10.8	2.9	4.4	.7	15.2	3.6
1967	7.8	2.6	4.0	.6	11.8	3.2
1968	12.2	3.4	6.5	1.6	18.7	5.0
1969	4.4	1.6	1.9	.4	6.3	2.0
1970	5.8	2.1	5.2	1.3	11.0	3.4
1971	7.1	1.9	4.0	.8	11.1	2.7
1972	10.6	5.0	2.0	.5	12.6	5.5
1973	6.2	5.3	2.7	1.8	8.9	7.1

**Figures for the years 1935-1957 inclusive, have been revised to maintain consistency in the method of reporting, therefore, value figures from original data within this period are excluded.*

SOURCES:

Fisheries of the United States, National Oceanic and Atmospheric Administration, National Fisheries Service, C.F.S. No. 5600, March 1971, C.F.S. No. 5900, March 1972, C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States, U.S. Dept. of the Interior, Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production, Commercial Fishery Statistics, Alaska Department of Fish and Game, Statistical Leaflets No. 23, 1971; No. 25, 1972; No. 26, 1973.

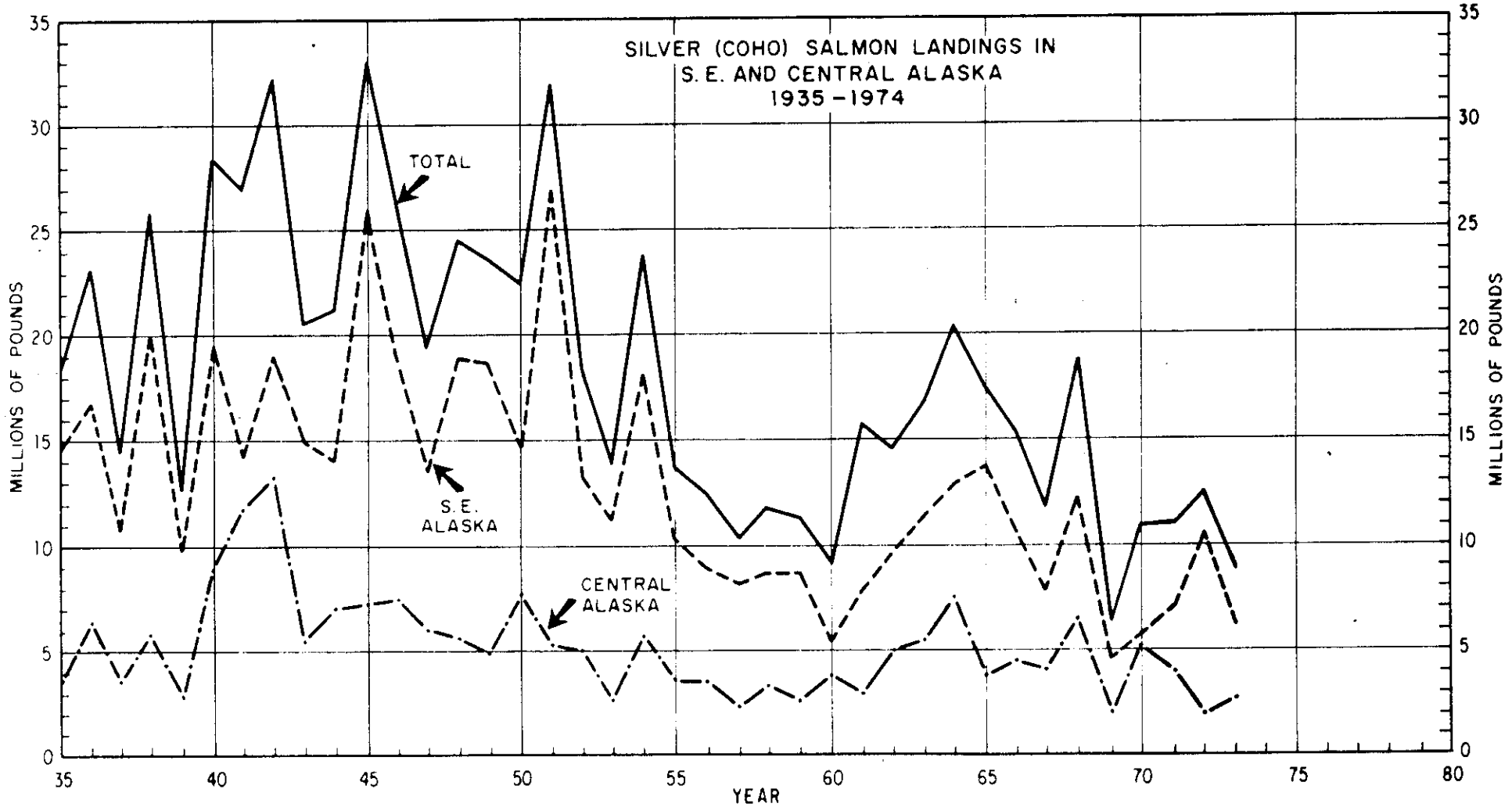

SILVER (COHO) SALMON LANDINGS IN
S. E. AND CENTRAL ALASKA
1935 – 1974
TOTAL
S.E.
ALASKA
CENTRAL
ALASKA
MILLIONS OF POUNDS
MILLIONS OF POUNDS
YEAR
35
40
45
50
55
60
65
70
75
80
0
5
10
15
20
25
30

Figure VI-8

SUMMARY OF ALASKA SALMON LANDINGS IN THE SOUTHEASTERN AND CENTRAL REGIONS BY SPECIES
1935-1973
Millions of Pounds & Millions of Dollars

	CHINOOK (KING)		CHUM (KETA)		PINK		RED (SOCKEYE)		SILVER (COHO)		TOTAL	
Year	Quantity	Value*	Quantity	Value*	Quantity	Value*	Quantity	Value*	Quantity	Value*	Quantity	Value*
1935	14.8	-	61.4	-	240.1	-	39.6	-	18.3	-	374.2	-
1936	16.0	-	79.2	-	335.6	-	77.6	-	23.2	-	531.6	-
1937	19.7	-	51.6	-	268.3	-	45.8	-	14.5	-	399.9	-
1938	16.2	-	54.9	-	239.6	-	49.2	-	25.9	-	385.8	-
1939	15.8	-	39.3	-	187.9	-	62.4	-	12.8	-	318.2	-
1940	10.4	-	61.1	-	215.5	-	37.0	-	28.4	-	352.4	-
1941	15.6	-	47.2	-	345.2	-	39.9	-	26.0	-	473.9	-
1942	14.3	-	67.9	-	207.7	-	34.3	-	32.2	-	356.4	-
1943	11.5	-	66.3	-	170.9	-	48.4	-	20.5	-	317.6	-
1944	8.7	-	74.3	-	155.3	-	43.6	-	21.1	-	303.0	-
1945	10.7	-	49.5	-	166.4	-	41.7	-	33.0	-	301.3	-
1946	14.4	-	49.6	-	152.0	-	30.0	-	26.5	-	272.5	-
1947	14.4	-	34.5	-	127.9	-	38.3	-	19.4	-	234.5	-
1948	12.9	-	52.2	-	96.8	-	26.2	-	24.5	-	212.6	-
1949	13.0	-	34.8	-	200.3	-	31.3	-	23.6	-	303.0	-
1950	11.4	-	55.2	-	81.3	-	40.7	-	22.5	-	211.1	-
1951	14.6	-	52.2	-	115.9	-	31.3	-	31.9	-	245.9	-
1952	11.0	-	68.2	-	87.0	-	32.6	-	18.3	-	217.1	-
1953	12.6	-	55.2	-	71.0	-	34.6	-	13.9	-	187.3	-
1954	11.0	-	71.7	-	84.9	-	30.1	-	23.7	-	221.4	-
1955	9.0	-	24.9	-	94.4	-	20.8	-	13.8	-	162.9	-
1956	7.0	-	49.8	-	87.9	-	31.5	-	12.4	-	188.6	-
1957	5.4	-	60.1	-	55.6	-	19.5	-	10.3	-	150.9	-
1958	7.5	2.4	56.8	3.9	112.6	10.5	15.0	3.4	11.8	2.1	203.7	22.3
1959	8.2	2.3	26.7	2.0	48.0	4.9	14.6	3.5	11.2	2.3	108.7	15.0
1960	5.8	1.9	35.1	3.0	49.7	6.5	18.5	4.4	9.1	2.2	118.2	18.0
1961	3.6	1.4	39.3	3.3	103.0	10.0	22.9	5.2	10.7	1.9	179.5	21.8
1962	4.7	2.0	50.0	4.3	134.1	19.3	25.0	5.9	14.5	3.1	228.3	34.6
1963	5.2	2.4	31.4	2.7	124.7	14.4	17.7	4.3	16.7	2.9	195.7	26.7
1964	7.1	2.9	54.2	4.1	157.0	16.6	23.7	5.9	20.3	3.5	262.3	33.0
1965	6.1	2.0	27.4	2.2	74.9	7.7	30.6	7.3	17.3	4.3	156.3	23.5
1966	5.2	2.1	47.6	5.3	154.8	21.2	34.5	9.0	15.2	3.6	257.3	41.2
1967	5.0	2.0	27.0	2.7	28.7	3.2	24.9	3.2	11.8	3.2	100.6	14.3
1968	5.8	2.4	51.8	6.5	138.8	19.1	31.6	8.4	18.7	5.0	246.7	41.4
1969	4.9	2.2	17.7	2.4	104.8	15.6	28.1	7.6	6.3	2.0	161.8	29.8
1970	5.6	3.9	45.2	5.6	113.3	15.0	41.7	11.1	11.0	3.4	216.8	39.3
1971	5.5	3.3	45.3	6.4	86.1	13.5	27.7	7.4	11.1	2.7	176.0	33.5
1972	4.5	2.7	55.5	10.9	59.4	10.7	26.2	8.9	12.6	5.5	158.6	38.7
1973	5.6	6.9	35.7	15.6	36.3	11.6	26.0	12.1	8.9	7.1	112.5	53.3

Figures for the years 1935-1957 inclusive, have been revised to maintain consistency in method of reporting, therefore, value figures from original data within this period are excluded.

SOURCES:

Fisheries of the United States. National Oceanic and Atmospheric Administration, National Fisheries Service. C.F.S. No. 5600, March 1971. C.F.S. No. 5900, March 1972. C.F.S. No. 6100, March, 1973, and C.F.S. No. 6400, March 1974.

Fishery Statistics of the United States. U.S. Dept. of the Interior. Bureau of Commercial Fisheries, Statistical Digests from 1939-1967.

Fishery Statistics of the United States. National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Statistical Digests No. 62, 1968; No. 63, 1969; No. 64, 1970; No. 65, 1971.

Alaska Catch and Production. Commercial Fishery Statistics. Alaska Department of Fish and Game. Statistical Leaflets No. 23, 1971, No. 25, 1972; No. 26, 1973.

Table VI-11

VII. THE STEELHEAD RESOURCES

INTRODUCTION

Steelhead trout (Salmo gairdneri gairdneri, Richardson) are anadromous rainbow trout highly valued by both sports and commercial fishermen. Since 1892, this species has comprised a small, but noticeable, part of the commercial anadromous salmonid catches in California, Oregon, Washington, British Columbia, and Alaska.

During the last two decades, there have been obvious trends toward the reduction of the commercial fishery, with a concurrent marked increase in the sports fishery [27].

DISTRIBUTION

The original geographic range of the steelhead trout probably extended from Alaska to some of the rivers in the northern Baja Peninsula of Mexico. Today, its range is somewhat reduced. The lack of consistent commercial catches in Bristol Bay for this species and the examination of so-called steelhead populations in the river systems of Bristol Bay indicate that the probable western range limit occurs along the southwestern Kenai Peninsula of Alaska, as far west as the Chignik River. The northern limit is probably in the drainage systems of the Kenai, Copper, or Ninilchik Rivers.

NATURAL HISTORY NOTES

Fresh-Water Stage

During spawning, as many as ninety-five percent of the eggs are fertilized and buried successfully in the gravel. The time required for steelhead eggs to hatch varies with the water temperature. The usual rule of thumb is fifty days at 50°F, with three days added for every one degree drop or subtracted for every one degree rise.

Silting is probably the principal factor in determining survival of fertilized eggs. Under favorable conditions, the average percentage of steelhead fry emerging from the gravel ranges between sixty-five and eighty-five percent of the eggs deposited. However, soon after the fry emerge, there begins a marked decline in the numbers due to various forms of natural mortality. Older rainbow trout, sea-run cutthroat trout, sculpins, great blue herons, mergansers, predatory bettles and mammals, utilize these young fish as a source of food[27].

After the fry emerge, they feed on microscopic organisms passing to them in the current. As they develop, the fry begin to move into deeper parts of the stream and to establish territories among the rocks in the riffle areas. With their increasing size, the food preferences change to aquatic and terrestrial insects (e.g., trichopterans, dipterans, amphipods and isopods).

Juvenile steelhead remain in fresh water from one to four years before undergoing smoltification, which permits them to live in a marine environment. Once a fish attains a length of from six to eight inches,

smoltification commences provided that it is the correct season. Steelhead migrate to sea during all times of the year; however, the largest numbers migrate during April through June, with a peak usually occurring around mid-April in Oregon and Washington. It appears that the juvenile steelhead also imprint on their location at this time in their life history, thus enabling them to return to their home stream during their first spawning migration. The survival of seaward migrants is apparently related to their size, because smaller migrants (usually age one year fish) have about 2.5 percent chance of survival to spawning adult, while somewhat larger smolts (age two and three years) have survival rates of 6 percent and 18 percent, respectively.

Ocean Stage

After the juvenile steelhead reach the ocean, they undergo a rapid growth phase which is made possible by the abundant food supply. A two- to three-year residency in the ocean will result in juvenile steelhead of up to thirty pounds; however, the average size for a mature ocean fish is from five to ten pounds.

Investigations into the oceanic phase of the steelhead's life history are relatively limited. The food habits of this species appear to be composed of squid, amphipods and greenling. During the course of high-seas salmon investigations since 1956 under the auspices of the International North Pacific Salmon Commission (I.N.P.S.C.), some information has become available concerning the movements of the steelhead trout during their oceanic phase. Figure VII-1 indicates the various I.N.P.S.C. scientific areas where steelhead

trout originating in Washington, Oregon and California were captured by either gill nets or purse-seines between 1956 and 1969. Although steelhead trout are difficult to sample on the high seas because they do not form schools as salmon do, evidence indicates that steelhead from Washington, Oregon and perhaps Idaho spend at least part of their ocean residency in the Alaskan gyre. It seems possible that the steelhead may be moving with the currents within the gyre in the same manner as has been suggested for the Pacific salmon. Steelhead tagged in both the Gulf of Alaska and off Adak Island, Alaska, return to North American coastal streams. Figure VII-2 indicates the distribution of steelhead trout of British Columbia origin in the Gulf of Alaska as based on the same I.N.P.S.C. sampling studies. These steelhead do not appear to travel as far west as their counterparts; however, they appear to be also associated with the currents of the Alaskan gyre. These studies also indicated that the steelhead were travelling in the upper forty feet of the water column[27].

Spawning Migration

Two races of steelhead trout exist which are separated on the basis of their spawning migration: "winter steelhead," which migrate upstream during the fall months; and those which migrate upstream during the late spring and summer months, or "summer steelhead." The winter steelhead begin the runs in their home streams in late October and November and reach a peak from January through March. In contrast, the summer steelhead enter their home streams in late spring and summer months as green fish which do not mature and spawn until the following spring.

In general the bulk of the steelhead enter their home streams during either the months of December to February (winter run) or the months of August and September (summer run)[27].

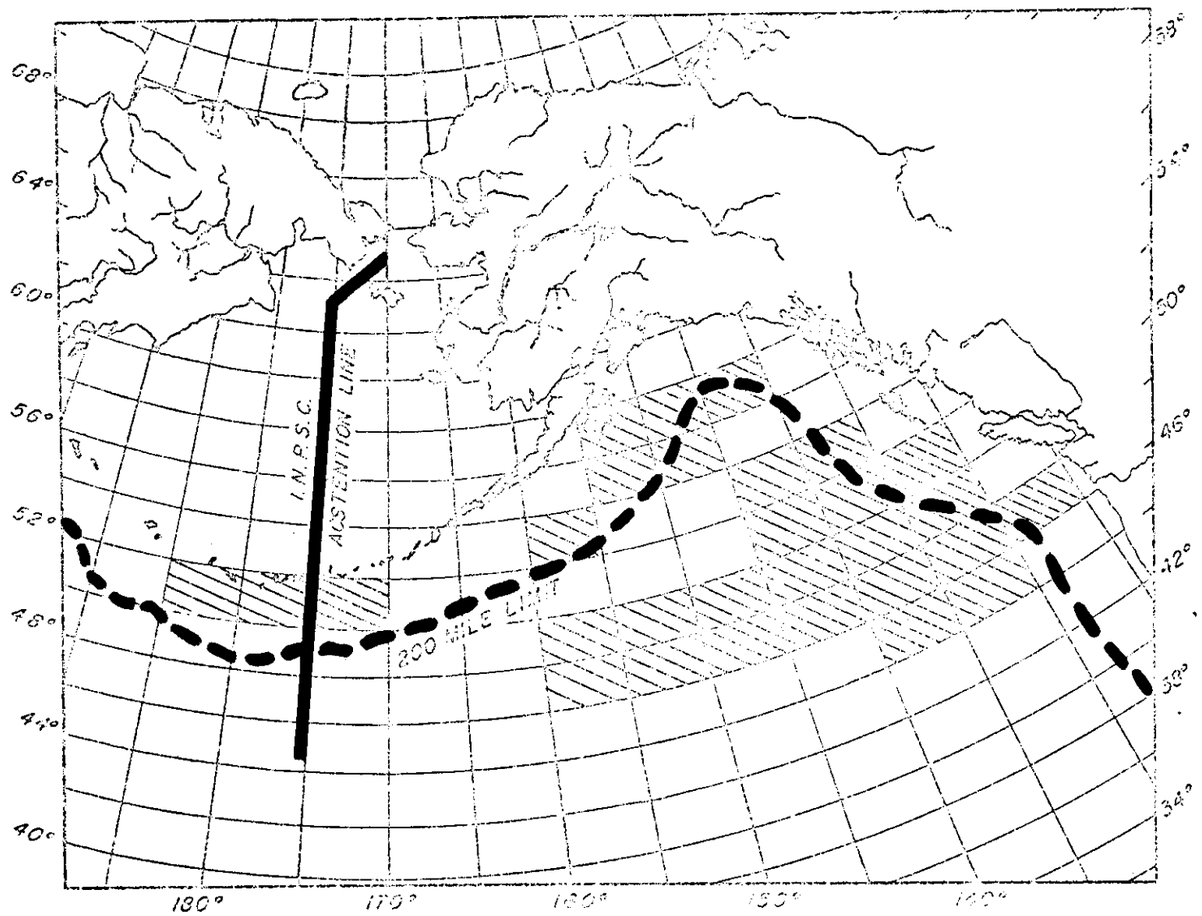


Figure VII -1 Oceanic distribution for steelhead trout *(Salmo gairdneri)* of Washington, Oregon and California origin based on I.N.P.F.C. tagging-recapture studies, 1956-1969.

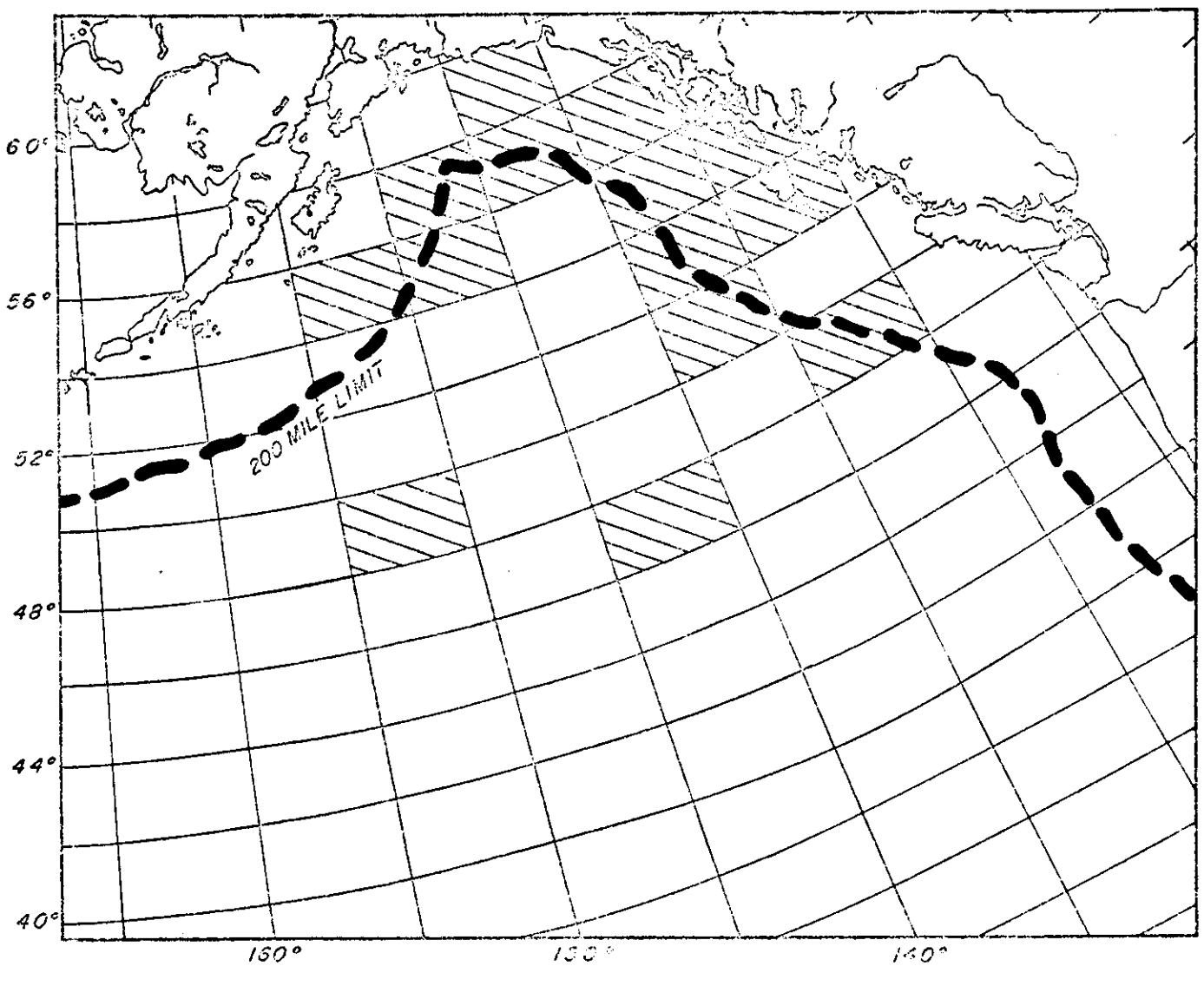


Figure VII -2 Oceanic distribution for steelhead trout *(Salmo gairdneri)* of British Columbia origin based on I.N.P.F.C. tagging-recapture studies, 1956-1969.

COMMERCIAL FISHERY

Commercial fishing for steelhead has been carried on in certain areas of the Pacific northwest since the mid-1800's. However, the first published commercial catch statistics for steelhead trout appeared in 1892. At that time, three states (Washington, Oregon and California) had active commercial fisheries with a combined annual catch of 5.3 million pounds (round weight) of steelhead trout[27]. Following a peak catch of 8.65 million pounds in 1895, there has been a definite decline in the commercial catch to approximately 900,000 pounds in 1968. Major causes of this decline have been the cessation of commercial steelhead fishing in California in 1924; the restriction of commercial fishing for steelhead in Washington to various Indian tribes on their reservations; and the reduction of the commercial fishing season particularly on the Columbia river. Despite the marked reduction in the total commercial steelhead catches, the 1968 catch was valued at $246,000 even though the catch was only about one-half the weight of the 1945 catch, which had the same cash value [27].

Commercial catch statistics for steelhead trout in Alaska are presented in Table VII-1 for the period from 1932 to 1967. The central and southeastern districts of Alaska are the regions where steelhead are taken commercially. The 25-year average for the Alaskan fishery (1942-1967) was 16,219 pounds, and its average value was $2,746. The average annual catch from 1960-1967 was 17,429 pounds, with a corresponding value of $3,535. The 1973 catch [3] of 17,709 pounds suggests that the steelhead are being harvested incidentally with the various species of Pacific salmon. The main types of gear employed (drift gill nets and occasionally purse seines) support this observation[27].

TABLE VII-1

Summary of Commercial Steelhead Trout
Catches for Alaska

(Round weight in thousands of pounds.)

YEAR	ALASKA
1932	3
1933	11
1934	52
1935	12
1936	42
1937	22
1938	8
1939	(1)*
1940	(1)*
1941	(1)*
1942	(1)*
1943	14
1944	3
1945	18
1946	38
1947	3
1948	1
1949	4
1950	19
1951	2
1952	31
1953	38
1954	37
1955	19
1956	19
1957	7
1958	12
1959	9
1960	16
1961	14
1962	10
1963	20
1964	10
1965	13
1966	31
1967	26

*(1) Incomplete data.

Ref: 3,27

VIII: SPORT AND SUBSISTENCE FISHING

SPORT FISHING

Sport fishing, as a recreational outlet in Alaska, has markedly increased within recent years, and will probably continue to increase, providing both recreational and economic returns to Alaskans.

Information on sport fishing is not available on an area-wide basis for any region of Alaska except the Southeast Alaska Salmon Fishery and some limited data from the Prince William Sound and Kodiak areas. Although many places, such as the Kenai Peninsula and Bristol Bay, have intensive and productive sport fisheries, they are localized and in terms of commercial catches or total population of the region, cannot be quantified(28).

From 1965 through 1970, the number of anglers in Alaska increased on an average of 10 percent annually, with the largest increases occurring in 1966 (13 percent) and in 1970 (14 percent).

TABLE VIII-1 ESTIMATED ANGLER SPORT CATCH (SALMON AND STEELHEAD) IN ALASKA (1965-1970)

YEAR	ANGLERS	TOTAL CATCH	% ANNUAL ANGLER INCREASE	% ANNUAL HARVEST INCREASE
1970	113,394	103,000	14.17	28.83
1969	99,323	78,250	9.67	-2.13
1968	90,565	76,000	6.72	-4.94
1967	84,850	79,950	10.27	6.98
1966	76,950	74,735	13.17	13.89
1965	67,904	65,623		
TOTAL	532,986	111,755		

Although the annual increase of anglers has remained fairly stable, the annual increase of the sport harvest has been variable. The total catch has increased annually at an average of 6.5 or more percent. However, the

1968 and 1969 sport harvests showed annual decreases as compared with 1967. The 1970 sport harvest increased by 28.8 percent over 1967.

The intensive sport fishing areas of Alaska are primarily located in areas of high population density and easy accessibility. Trends of salmon harvest, and angling pressure, are discussed for three areas related to the Gulf of Alaska: Seward, Valdez, and Kodiak Island.

An estimated gross value exceeding $11 million, based upon studies in Washington and Oregon, is annually generated by the Alaskan sport fishermen. A gross investment of more than $60 million in salt water sport fishing gear and activities has been estimated.

Seward

Sport fishing is primarily for coho salmon in Resurrection Bay. King and pink salmon are incidentally caught, but the catch of these species may be underestimated as censuses do not entirely encompass their period of availability.

TABLE VIII-2 ESTIMATED HARVEST OF COHO SALMON IN THE SEWARD AREA: 1961-1969

YEAR	SPORT HARVEST	TOTAL EFFORT (MAN-DAYS)
1961	5,504	6,002
1962	14,482	11,380
1963	7,293	15,430
1964	2,971	7,540
1965	4,020	13,380
1966	9,590	14,195
1967	17,380	20,100
1968	22,560	25,350
1969	15,040	24,655

Generally the sport harvest and fishing effort have increased annually. Through the period 1961-1969, the average annual harvest (estimated)

and fishing effort (estimated) was 10,982 coho salmon and 15,338 man-days, respectively. The 1969 catch of king salmon was 595 fish.

Information on angling method is unavailable. A small boat harbor at Seward has the only docking and boat launching facilities for anglers.

Kodiak Island

Data concerning the sport fishery of this area is lacking. The Buskin River maintains a salmon sport fisher; and in 1969, 584 anglers fished 1,267 hours to catch 2,114 coho salmon and 804 pink salmon. These anglers also havested 3,319 sea-run dolly varden trout during this period. Steelhead trout exists in the Karluk River, but due to the isolation of this stream, the harvest is light[24].

Valdez

The sport fishing season in Valdez runs from June until September. This area supports a small sport fishery, but detailed information is lacking. This is largely a silver salmon fishery. For the years 1963 and 1964, a creel census from the Military Recreation Camp on Valdez Bay indicated that 68 anglers harvested 702 salmon[24].

SUBSISTENCE FISHING

It has been estimated that the average subsistence catch of salmon and fresh water species by native Alaskans during the past decade has been about 750,000 fish, substantially below that taken for traditional native subsistence needs 30 or 40 years ago.

The state authority has recognized the importance of fish and wildlife to native survival and subsistence. Accordingly, in most places state law and regulation have recognized subsistence needs. Today in all of Alaska, with all its resources, it is the fishery resource alone which offers any significant broad commercial economic base to the Alaska native.

There are subsistence fisheries (salmon caught for personal use as human or dog food) by local residents in Prince William Sound and the Copper River. The largest of these fisheries is the dip net and fishwheel fisheries on the upper Copper River. In 1970, about 36,500 red salmon, 400 king salmon, and 550 coho salmon were taken by local residents in this area[22, 23, 24].

IX. FOREIGN FISHERIES - GULF OF ALASKA

INTRODUCTION

Large Russian and Japanese trawling fleets dominate the groundfish fisheries of the Gulf of Alaska. Since 1962, these two countries have fished from the Aleutian Chain to the Washington-Oregon coast. Their operations in the Gulf have been similar in that both employ mainly large factory stern trawlers to harvest primarily Pacific Ocean perch. Japanese fleets have tended to operate in the northern parts of the Gulf of Alaska where they began full-scale commercial longline operations for blackcod in 1968. The Soviets have emphasized the harvest of hake off Vancouver Island and the Washington-Oregon coast.(19)

Until the early 1960's, the groundfish resources of the Gulf of Alaska were largely unexploited. Thirty years earlier, the Japanese began full-scale fishing operations in the Bering Sea, to the north of the Gulf, which continued intermittently until the outbreak of World War II. Groundifhsing by foreign fleets resumed again in the Bering Sea after the war with the reappearance of Japanese fleets in 1954 and the first large-scale Russian fishing operations in 1959.

Soviet trawling fleets moved into the western Gulf from the Bering Sea in 1962, with Japanese groundfish fleets following in 1963. Since then, these fleets, representing substantially larger investments of capital and labor than those of the United States and British Columbia, have steadily expanded their operational areas. The Russian expeditions in the Aleutian Islands grew rapidly; and, by 1965, the Soviets had established year-round fisheries in the Gulf of Alaska that extended south to Dixon Entrance.(19)

Development of the Japanese groundfish fleet closely followed the Russian pattern. From the Aleutian area, their fisheries expanded eastward. By 1966, their trawlers were operating as far as the Washington and Oregon coasts. Both the Russian and Japanese fleets were, by this time, conducting year-round groundfish operations in the Gulf of Alaska.(29)

South Korea also demonstrated an interest in the groundfish resources of the Gulf. Some exploratory trawling in the Aleutians and western Gulf was conducted in the late 1960's; but, as yet, South Korea groundfishing activity has not developed on a large scale.(19)

The rapid spread of Jpanese and Russian fleets across the continental shelf of the Gulf has been an important factor in the development of these countries as two of the major fishing nations of the world. The Japanese and Soviet fishing fleets include some of the world's most modern vessels, operating year-round off Alaska, and annually harvesting more than three billion pounds of fish, shellfish and whales. Numbers and total tonnage of Japanese groundfishing vessels for 1963-1969 are given in Table IX-1.(19)

TABLE IX-1 - NUMBER AND TOTAL TONNAGE OF JAPANESE GROUNDFISH VESSELS OPERATING IN THE NORTHEAST PACIFIC REGION, BY TYPE OF VESSEL, 1963-1969(34)

	Danish Seine		Side Trawl		Stern Trawl		Total	
Year	No. of Vessels	Total Tonnage	No. of Vessels	Total Tonnage	No. of Vessels	Total Tonnage	No. of Vessels	Total Tonnage
1963	-	-	2	1,024	1	1,454	3	2,478
1964	-	-	2	843	3	6,460	5	7,303
1965	5	1,678	3	1,221	6	15,848	14	18,747[a]
1966	2	589	3	1,450	14	32,099	19	34,138
1967	1	299	1	549	29	49,940	31	50,788[b]
1968	1	299	1	549	29	49,940	31	50,788[b]
1969	-	-	-	-	42	93,608	42	93,608[b]

SOURCE: International North Pacific Fisheries Commission, 1971.
[a]Includes one mothership which did not fish.
[b]Number licensed.

Japanese Fisheries

The area of the Gulf exploited by the Japanese groundfish fleets has increased substantially since commercial operations first started in 1963. Factory stern trawling effort comprised over ninety percent of the total trawl effort during the 1964-1968 period, according to International North Pacific Fisheries Commission statistics (International North Pacific Fisheries Commission: 1969-1971).(30) In 1964 and 1965, fishing activity occurred from Kodiak west to the Aleutians. During 1966, the center of activity remained in this region, but some fishing, probably exploratory, was conducted as far south as the northern California coast. Commencing in 1967, Pananese trawling effort took on major dimensions along the eastern rim of the Gulf, from Kodiak to Vancouver Island, British Columbia, with the greatest effort centering in the Yakutat area.

The first year-round Japanese trawling activity in the Gulf of Alaska began in 1965. Most fishing from 1964 through 1968 occurred from April or May through December. During the southward expansion of the stern trawler fleet in 1967, effort was more concentrated in the latter half of the year. During 1968, as the center of activity shifted slightly northward again, the gulk of trawling took place between April and September.

Not all groundfish caught by the Japanese in the Gulf of Alaska are harvested by trawl gear. A longline fishery using gear similar to the United States-Canadian halibut fishery has existed in the Gulf since late 1963.(29) Until 1968, this was a small-scale fishery. However, in that year, about thirteen percent of all groundfish caught by the Japanese in the Gulf were harvested by longline. Most of this effort was concentrated in the Yakutat and southeastern areas, but occurred throughout most of the year.(30)

The dominant species in the catches of Japanese stern trawlers operating in the Gulf of Alaska is the rockfish species, Sebastes alutus, the Pacific Ocean perch. For the year 1966-1968, ocean perch comprised an average of seventy-four percent of the total catch (Table IX-2).[30] Relatively minor amounts of pollock (Theragra chakogrammus), blackcod or sablefish (Anoplopoma fimbria) and other species made up the remainder of the catch for these years. Percent composition is quite similar for all three years. For the 1966-1968 period, ocean perch predominated in the catches of all areas in the Gulf. During these years, the Shumagain area yielded unusually high catches of pollock, the mainstay of the Japanese trawl fishery in the Bering Sea. The incidence of ocean perch in stern trawl catches remained high throughout the year in most areas, but became more variable in areas where other species entered more prominently into the catch. Data from the longline fishery, begun intensively in 1968, indicate that this is primarily a blackcod fishery. With the exception of the Kodiak area, blackcod comprised from ninety to one hundred percent of the longline catch by Japanese groundfish vessels in 1968.[19]

TABLE IX-2 - METRIC TONS AND PERCENT COMPOSITION OF SPECIES IN THE JAPANESE STERN TRAWL FISHERIES IN THE GULF OF ALASKA (t = trace amount, less than one percent)[24]

Species	1966 m.t.	%	1967 m.t.	%	1968 m.t.	%	All Years m.t.	%
Pacific Ocean Perch[a]	70,386	77	75,162	71	72,924	76	218,472	74
Blackcod	3,713	4	6,843	7	5,530	5	16,086	6
Pollock	9,004	10	6,603	6	6,320	6	21,927	8
Pacific Cod	1,268	1	2,205	2	872	1	4,255	1
Yellowfin Sole	15	t	27	t	12	t	54	t
Pink Shrimp	1	t	58	t	745	1	804	t
Others	6,950	8	14,673	14	10,601	11	32,224	11
TOTAL	91,337		105,571		96,504		293,512	

Note: t = trace amount, less than one percent.
[a]This category may contain variable amounts of other rockfishes because of difficulties in separating closely related species.

Russian Fisheries

Fishing operations by the Soviet Union for groundfish in the Gulf of Alaska have utilized both side trawlers and factory stern trawlers. Side trawlers are of three types: the SRT (medium fishing trawler), 125 feet long and 265 gross tons (Figure IX-1)[31]; the SRTR (refrigerated medium fishing trawler), 167 feet and 505 gross tons (Figure IX-2); and the SRTM (freezing medium fishing trawler), 178 feet and 929 gross tons (Figure IX-3). One type of factory trawler has been prevalent in the Gulf: the BMRT (large freezer fishing trawler), 278 feet in length and 3,170 gross tons (Figures IX-4, 4a and 4b). These vessels are accompanied by various support ships: freezer ships (Figures IX-5, 5a, 5b, 5c and 5d); refrigerated transports (Figures IX-6, 6a, 6b, 6c and 6d); cargo ships; tankers; and rescue tugs. Fishing operations carried on by Russian side and stern trawlers are similar to those of the Japanese. There also has been a steady increase in the number of independent Soviet operations, in terms of gross tonnage, as seen in Table IX-3.[29]

TABLE IX-3 - NUMBERS AND TOTAL GROSS TONS OF RUSSIAN TRAWLING VESSELS, BY TYPE, OPERATING IN THE GULF OF ALASKA, 1962-1966[24]

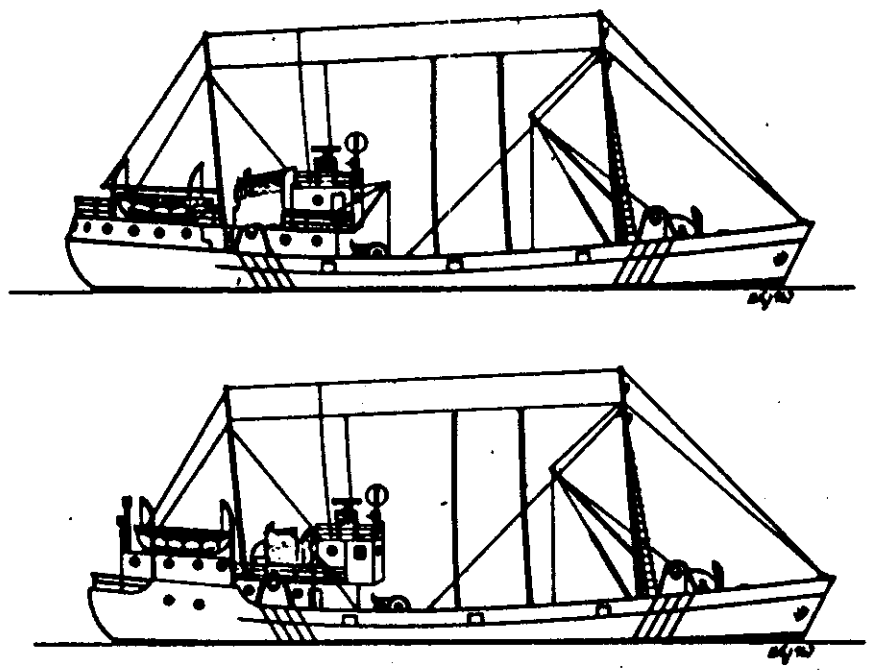
Vessel Type		1962	1963	1964	1965	1966
Dependent Trawlers (primarily SRT's)	No.	123	162	246	325	258
	Gross Tons	38,000	53,000	75,000	105,000	90,000
Independent Trawlers (primarily SRTM's & BMRT's)	No.	11	22	56	78	101
	Gross Tons	30,000	60,000	113,000	143,000	173,000

Owing to the fact that the U.S.S.R. is not a member country of the International North Pacific Fisheries Commission, data on Russian fishing activity in the Gulf of Alaska is available primarily from United States surveillance

activities. Starting in 1967, more information became available through data exchanges by bilateral agreement between the U.S.S.R. and the United States. Statistical areas established by this agreement are shown in Figure IX-7. From Table IX-4[29] the pattern of the yearly expansion of Russian fishing effort can be seen. From 1962 through 1966, the areas covered by the Soviet fleets increased steadily until they encompassed waters from the Aleutians to the Oregon coast. The number of sightings of Russian trawlers in the Gulf also increased steadily, peaking in 1965. For the 1967-1969 period, data on trawling hours is available through United States-Russia data exchanges. Total trawling hours have declined, but the decline has been partially offset by the increased incidence of large factory trawlers (BMRT's) in the fleet. Side-trawler effort has dropped to insignificant amounts, while BMRT effort declined about 50 percent through 1969. The seasonal nature of the fishery is also shown in Table IX-5, especially for the Aleutian Islands, British Columbia and Oregon-Washington areas, where the time of most activity was the April-September period. Effort was lowest during the spring-summer period in the western Gulf.

TABLE IX-4 - AREAS, SEASONS AND MAXIMUM NUMBER OF VESSELS OBSERVED DURING 1962-1966 BY UNITED STATES SURVEILLANCE OF RUSSIAN GROUNDFISHING ACTIVITY IN THE GULF OF ALASKA

Year	Areas Fished	Season	Maximum of Number Vessels Observed	Month
1962	Western Gulf	Jul. - Dec.	70	
1963	Aleutian Islands, Western Gulf	Mar. - Dec.	157	
1964	Aleutian Islands, Western Gulf, Eastern Gulf	Feb. - Dec.	180	May
1965	Aleutian Islands, Western Gulf, Eastern Gulf, British Columbia	Jan. - Dec.	195	May
1966	Aleutian Islands, Western Gulf, Eastern Gulf, British Columbia, Oregon-Washington	Jan. - Dec.	145	Feb.



VESSEL TYPE: Side Trawler (Drifter Trawler)
VESSEL CLASS: SRT - 400 (CRT)

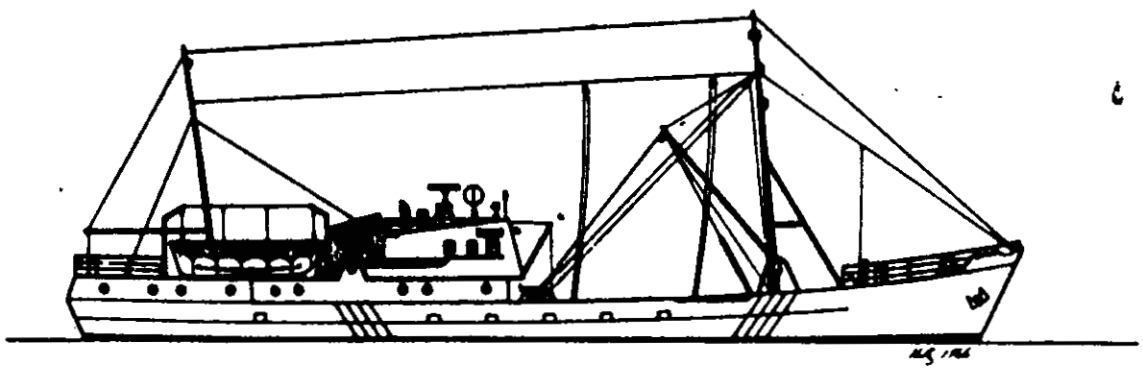
Length over all:	125-144 39-44 m.	**Speed:**	9-10 knots
Beam:	24-25' /.2-7.6 m.	**No. in crew:**	22-26
Draft:	9' 2.8 m.	**Where built:**	East Germany (GDR)
Disp. tonnage (loaded-light):	385-500 tons	**When built:**	1949-1959
Deadweight (metric tons):	Unknown	**No. built:**	1,000
Gross tonnage:	230-264 tons	**Endurance:**	21-30 days
Propulsion type:	Diesel motor	**Hold capacity:**	100-200 tons
Horsepower:	300-400	**Fuel capacity:**	Unknown
No. Screws:	1 (FB)	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
This vessel generally trawls with the 21 or 25 m. (69 or 82') trawl and either the 425 kg. (937 lb.) flat trawl boards or the 563 kg. (1,241 lb.) oval boards. Trawling is conducted from either the port or starboard sides. The trawl winch is 2-drum, electrical, and has a pulling force of 14,000 kg. (8,819 lb.). The cable diameter is 21 mm. (.82 inch). The vessel when drift or gill net fishing uses nets of various lengths and numbers. They use a power capstan for hauling the warp of the gill nets, a power roller for bringing the nets over the rail, and a powered deck shaker to remove the fish from the net.

Production Capacity:
The holds of these vessels have no freezing or chilling equipment, so the catch must be delivered to the processing ship.

Remarks:
One of these vessels, the **Kashahipaa** (SRT 184) docked in Boston during June 1961, CFR 23(9) p. 41-43. A number have been converted to research ships. Some of their names are: **Akademik S. Vavilov; Mzirbe** (SRT-4576); **Okeanograf; Pervenets; Pollarnik; Zhemchug; A. Otkupshchikov** (SRT-440); **Topseda** (SRT-18); **Akademik A. Koralevski.**

Pertinent References:
Anon. (1961), Kravanja (1964).



VESSEL TYPE: Side Trawler (SRTR)
VESSEL CLASS: Okean

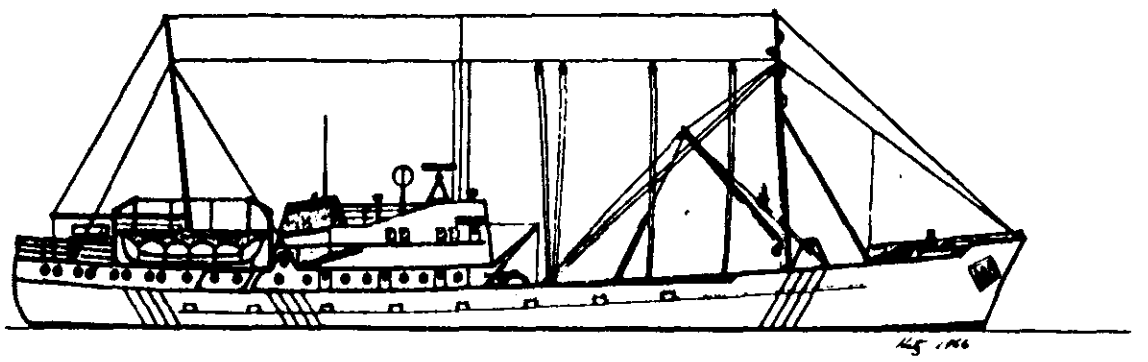
Length over all:	167' 50.8 m.	**Speed:**	11 knots
Beam:	29' 8.8 m.	**No. in crew:**	26-28
Draft:	11' 3.4 m.	**Where built:**	East Germany (GDR)
Disp. tonnage (loaded-light):	650-740 tons	**When built:**	1958-1960
Deadweight (metric tons):	150-200 tons	**No. built:**	171
Gross tonnage:	505-630 tons	**Endurance:**	40 days
Propulsion type:	Diesel motor	**Hold capacity:**	12,148' 344 m.
Horsepower:	540-650	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
This vessel generally trawls with the 25 m. (82') trawl and 563 kg. (1,241 lb.) oval boards. Trawling is conducted from the starboard side only. The trawl winch is electric and has 2 drums, a pulling force of 5,443 kg. (12,000 lb.), a hauling speed of 60 m. (197') per minute, and a drum capacity of 600 m. (1,968') of 21 mm. (.83") diameter cable. Drift nets or gill nets that are used vary in length and number. The vessel uses a power capstan for hauling the warp, a power roller for bringing the nets aboard, and a powered deck shaker to remove the fish. Purse seines are fished by using the life boats or dories. These boats are 7.9 m. (26') long by 2.6 m. (8.6') wide. There speed is about 7.6 knots and they have enough fuel for 24 hours.

Production Capacity:
There annual average production per vessel ranged from 600 to 2,000 tons between 1959 and 1963. They can carry 150 to 200 tons of fish products in chilled holds at -4°C (25°F). They have a fresh water distilling plant.

Remarks:
These vessels are often used for locating fish for the fleet, since their catch can be chilled and delivered to processing ships later.

Pertinent References:
Schiffbautechnik (1961), Kravanja (1964).



VESSEL TYPE: Side Trawler (SRTM)
VESSEL CLASS: Mayak

Length over all:	178′ 54.2 m.	**Speed:**	11.6 knots
Beam:	30′ 9.3 m.	**No. in crew:**	30
Draft:	10′ 3.1 m.	**Where built:**	USSR
Disp. tonnage (loaded-light):	930-918 tons	**When built:**	1962 - still building
Deadweight (metric tons):	307-239 tons	**No. built:**	Unknown
Gross tonnage:	929 tons	**Endurance:**	33 days
Propulsion type:	Diesel motor	**Hold capacity:**	12,537′ 355 m.
Horsepower:	800	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

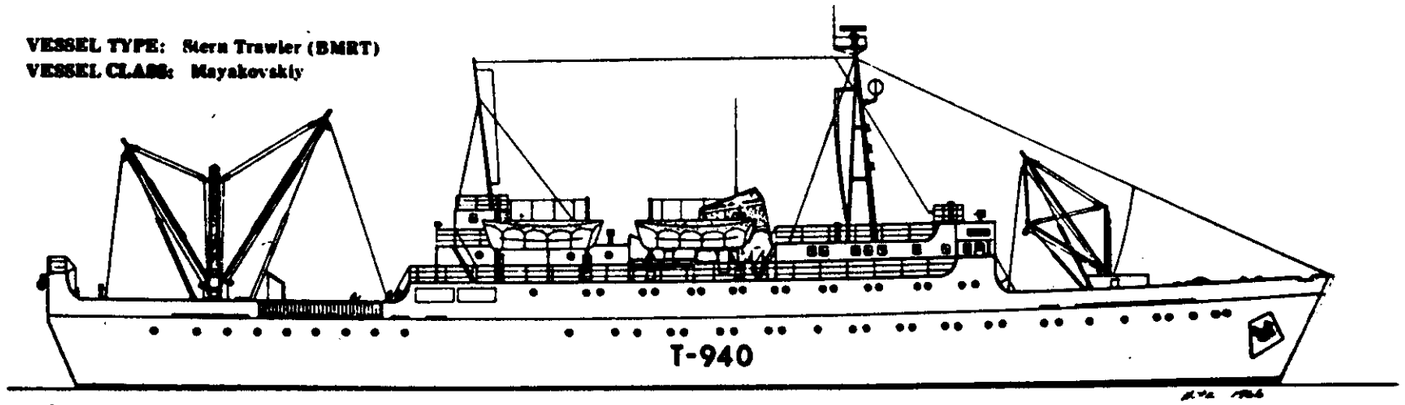
Type of Fishing Gear:
This vessel trawls with the 25 m. (82′) trawl and 563 kg. (1,241 lb.) oval boards generally. Trawling is conducted from the starboard side only. The trawl winch is electric and has 2 drums, a pulling force of 5,443 kg. (12,000 lb.), a hauling speed of 60 m. (197′) per minute, a setting speed of 120 m. (394′) per minute, and a drum capacity of 570 m. (1,870′) of 20 mm. (.79″) diameter cable. Pulling force at 4 knots is 7.5 tons. The drift nets or gill nets that are used vary in length and number. The vessel has a power capstan for hauling the warp of the nets, a power roller for bringing the nets aboard, and a power shaker for removing the fish.

Production Capacity:
This vessel can freeze about 6 tons of fish products per day, and distill 3 tons of fresh water per day. They can hold their frozen fish products at -18°C (-0.4°F) and salted herring at 1°C to 5°C (34°F to 41°F).

Pertinent References:
Dubskii (1962), Gorinov (1962).

FIGURE IX-4

VESSEL TYPE: Stern Trawler (BMRT)
VESSEL CLASS: Mayakovskiy

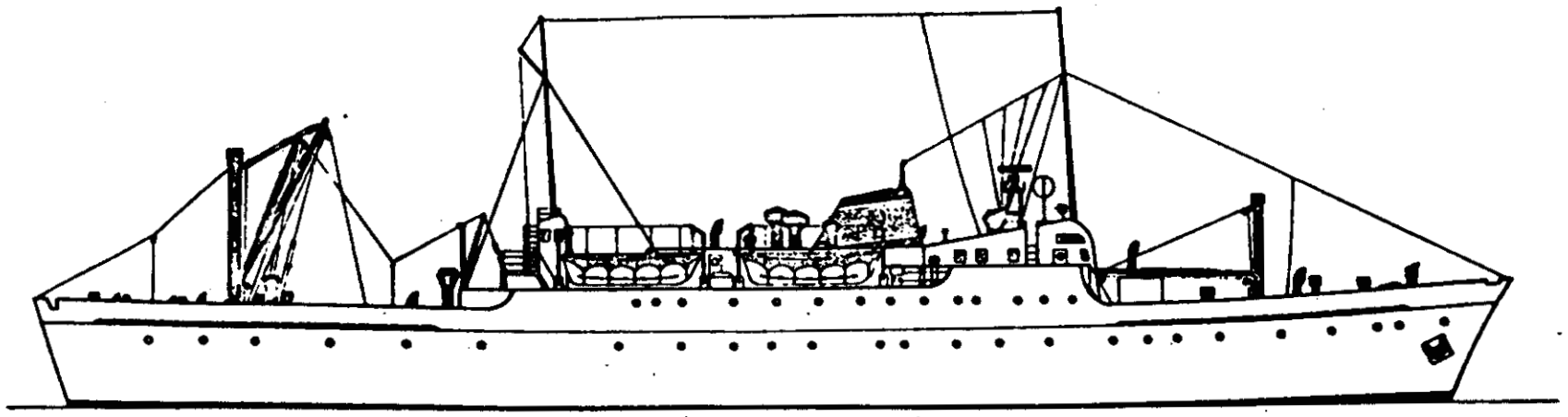


Length over all:	278′ 84.7 m.	**Speed:**	13.7 knots
Beam:	46′ 14 m.	**No. in crew:**	102-114
Draft:	18′ 5.5 m.	**Where built:**	USSR
Disp. tonnage (loaded-light):	3,712-3,658 tons	**When built:**	1958 - still building
Deadweight (metric tons):	1,301 tons	**No. built:**	100 (at end of 1966)
Gross tonnage:	3,170 tons	**Endurance:**	80 days
Propulsion type:	Diesel motor	**Hold capacity:**	58,658′ 1,661 m.
Horsepower:	2,000	**Fuel capacity:**	Unknown
No Screws:	1 (CP)	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
The vessel trawls with a 37.7 m. (124′) trawl and 970 kg. (2,138 lb.) oval trawl boards. The trawl winch is electric and has 2 drums, a pulling force of 12,000 kg. (26,000 lb.), a hauling speed of 60 m. (197′) per minute and a drum capacity of 2,500 m. (8,202′) of 28 mm. (1.02″) diameter cable.

Production Capacity:
The annual production of a top vessel in 1964 was 15,000 tons. The hold capacity of fish products is about 900 tons and the frozen products are stored at -18°C (-0.4°F). The maximum daily capacity of frozen products is 20 tons of fillets and 10 tons of dressed fish which are frozen at -40°C (-40°F). The meal plant can handle 20 tons of waste per day, the oil plant can use 1.6 tons of livers per day, and the canning plant has the capacity to process 3,500 tins of liver a day. Approximately 14 tons of distilled water can be produced per day.

Remarks:
These vessels are often used in exploratory fishing operations.



VESSEL TYPE: Stern Trawler (BMRT)
VESSEL CLASS:
Leskoĭ (Polish B-15 Trawler, Dalmor class)

Length over all:	279′ 85.2 m.	**Speed:**	12.5 knots
Beam:	45′ 13.8 m.	**No. in crew:**	75-110
Draft:	18′ 5.4 m.	**Where built:**	Poland
Disp. tonnage (loaded-light):	3,477-2,298 tons	**When built:**	1959-1962
Deadweight (metric tons):	1,240 tons	**No. built:**	70
Gross tonnage:	2,893-2,670 tons	**Endurance:**	70 days
Propulsion type:	Diesel motor (8-cylinder)	**Hold capacity:**	62,754′ 1,777 m.
Horsepower:	2,000 normal 2400 maximum	**Fuel capacity:**	29,311′ 830 m.
No. Screws:	1	**Fresh water capacity:**	8,652′ 245 m.

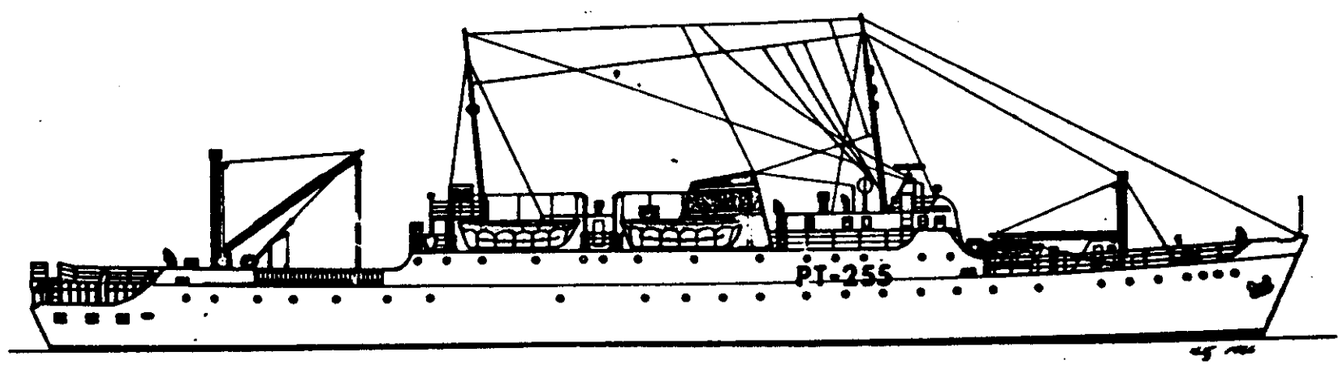
Type of Fishing Gear:
This vessel generally trawls with a 37.7 m. (124′) trawl, and the 970 kg. (2,138 lb.) oval trawl board. The trawl winch is electric, has 2 drums, a pulling force of 12,000 kg. (26,000 lb.), a hualing speed of 72 m. (236′) per minute, and a drum capacity of 2,000 m. (6,562′) of 26 mm. (1.02″) diameter cable.

Production Capacity:
This vessel can carry about 650 tons of frozen products in -18°C (-0.4°F) refrigerated holds. The maximum daily capacity of raw fish is 50 tons. She can freeze 30 tons of fish fillets per day or 27 tons of dressed fish (headed and gutted) per day. She can use 25-30 tons per day of fish wastes or scrap fish for fish meal, can process 3000 tins of liver per day, and has the facilities for rendering oil from livers and distilling water.

Remarks:
In Poland this vessel is classified as the B-15 series of trawlers and as the Dalmar class.

Pertinent References:
Piltz (1960), Kamenskii and Muragin (1961).

FIGURE IX-4a



VESSEL TYPE: Stern Trawler (BMRT)
VESSEL CLASS: Pushkin

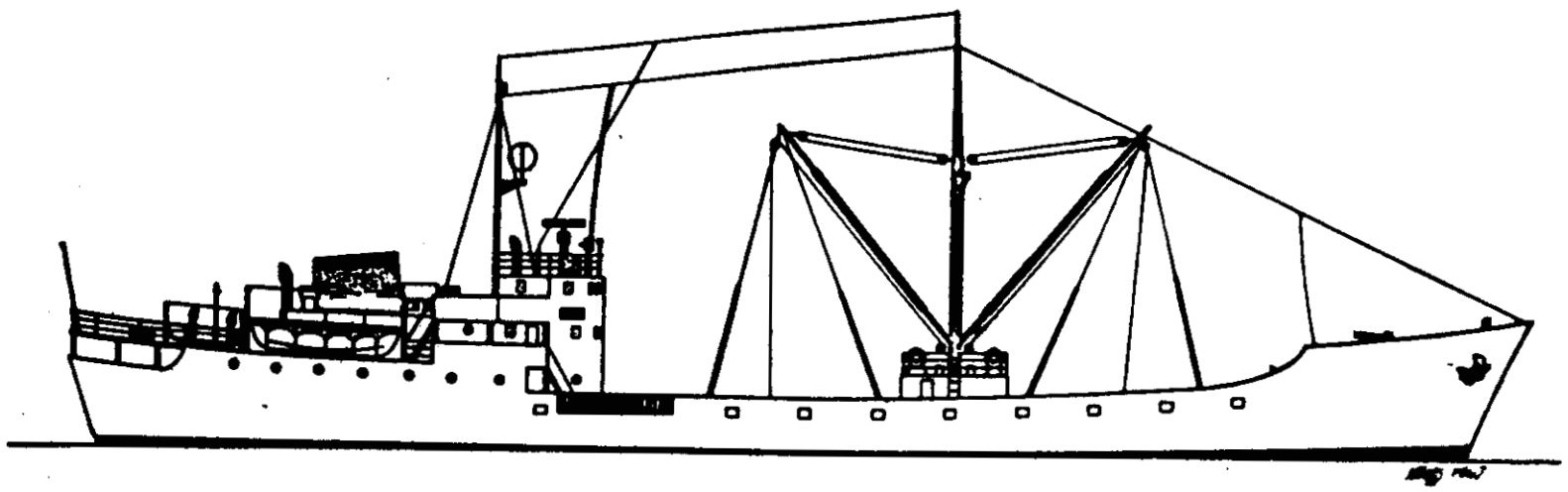
Length over all:	277' 84.5 m.	**Speed:**	12.5-13.5 knots
Beam:	44' 13.4 m.	**No. in crew:**	90-125
Draft:	17' 5.2 m.	**Where built:**	West Germany (GFR)
Disp. tonnage (loaded-light):	3,538-2,235 tons	**When built:**	1954-1956
Deadweight (metric tons):	1,230-1,242 tons	**No. built:**	12
Gross tonnage:	2,472-2,555 tons	**Endurance:**	60-80 days
Propulsion type:	Diesel motor	**Hold capacity:**	57,068' 1,616 m.
Horsepower:	1,900	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
This vessel generally trawls with a 37.7 m. (124') trawl and 970 kg. (2,138 lb.) oval trawl board. The winch is electric and it has 2 drums, a pulling force of 9000 kg. (19,841 lb.), a hauling speed of 60 m. (197') per minute, and a drum capacity of 1,500 m. (4,921') of 26 mm. (1.02") diameter cable.

Production Capacity:
The annual production in 1956 was 9,000 tons for the vessel, Pushkin, and 8,000 tons for a sister ship, Stalingrad, in 1955. This class can freeze 30 to 40 tons of fish fillets or dressed fish per day. They are stored in -18°C (-0.4°F) refrigerated holds. This class has the capacity to process 500 tins of fish and livers per hour as well as converting 25 tons of fish wastes to fish meal per day. They can also extract pure liver oil from fresh livers.

Remarks:
This class was the first of the Russian stern trawlers. The design was based on the British Fairty.

FIGURE IX-4b



VESSEL TYPE: Refrigerated Transport - Freezer
VESSEL CLASS: Kustanai (Polessk)

Length over all:	260′ 79.2 m.	**Speed:**	13.0-13.6 knots
Beam:	41′ 12.6 m.	**No. in crew:**	41-44
Draft:	20′ 6.1 m.	**Where built:**	Sweden
Disp. tonnage (loaded-light):	3,375 tons	**When built:**	1956
Deadweight (metric tons):	1,950-2,000 tons	**No. built:**	5
Gross tonnage:	1,750 tons	**Endurance:**	23 days
Propulsion type:	Diesel	**Hold capacity:**	66,568′ 1,885 m.
Horsepower:	1,700	**Fuel capacity:**	Unknown
No Screws:	1	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
None.

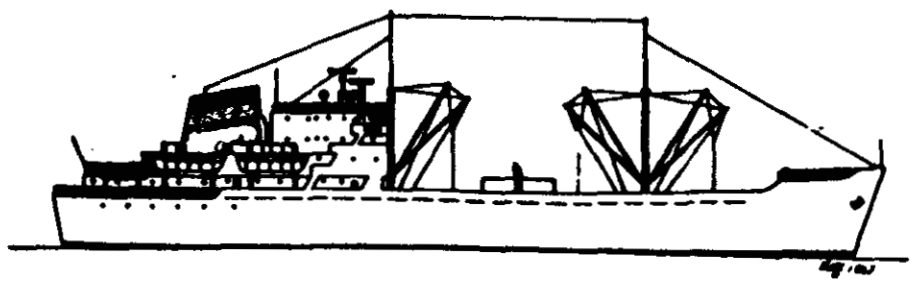
Production Capacity:
This vessel can hold as much as 1,540 tons of frozen cargo at -18°C (-0.4°F).

Remarks:
The **Polessk** is the name of one of these ships. The **Khabarov** class vessel is a similar ship.

Pertinent References:
Shipbuilding and Shipping Record (1956), Brady (1966), Grzywaczewski et al (1964) Table 26, p. 116.

FIGURE IX-5

FIGURE IX-5a



VESSEL TYPE: Refrigerated Transport — Freezer

VESSEL CLASS: Pervomaisk

Length over all:	328′ 100 m.	**Speed:**	12.7 knots
Beam:	47′ 14.4 m.	**No. in crew:**	Unknown
Draft:	28′ 8.5 m.	**Where built:**	Denmark
Disp. tonnage (loaded-light):	Unknown	**When built:**	1959-1960
Deadweight (metric tons):	Unknown	**No. built:**	4
Gross tonnage:	3,300 tons	**Endurance:**	Unknown
Propulsion type:	Diesel	**Hold capacity:**	Unknown
Horsepower:	1,920	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

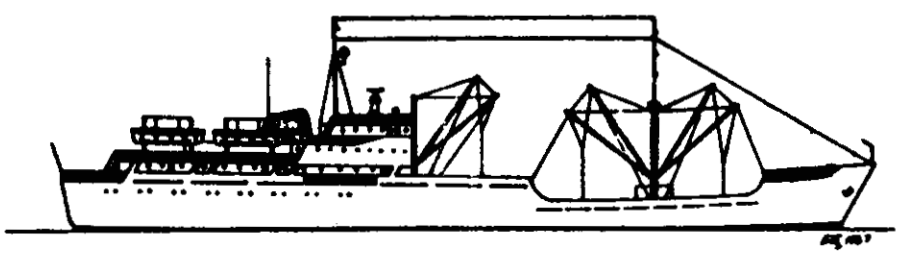
Type of Fishing Gear:
None.

Production Capacity:
This vessel freezes fish in freezer tunnels at -30°C (-22°F). The production is probably similar to the refrigerator class.

Remarks:
This class is a larger and modified version of the earlier refrigerator class vessel. The names of the four are **Pervomaisk, Juljus Janonis, Neva,** and **Primorsk.**

Pertinent References:
Brady (1966), Kravanja (1964).

FIGURE IX-5b



VESSEL TYPE: Refrigerated Transport — Freezer

VESSEL CLASS: Tavriya

327' 99.6 m.	**Speed:**	13.6-15 knots	
Beam:	46' 14.0 m.	**No. in crew:**	82
Draft:	18' 5.6 m.	**Where built:**	USSR
Disp. tonnage (loaded-light):	5,400-5,215 tons	**When built:**	1969-still building
Deadweight (metric tons):	2,540 tons	**No. built:**	Unknown
Gross tonnage:	3,230 tons	**Endurance:**	60 days
Propulsion type:	Diesel-electric	**Hold capacity:**	116,538' 3,300 m.
Horsepower:	4,000	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

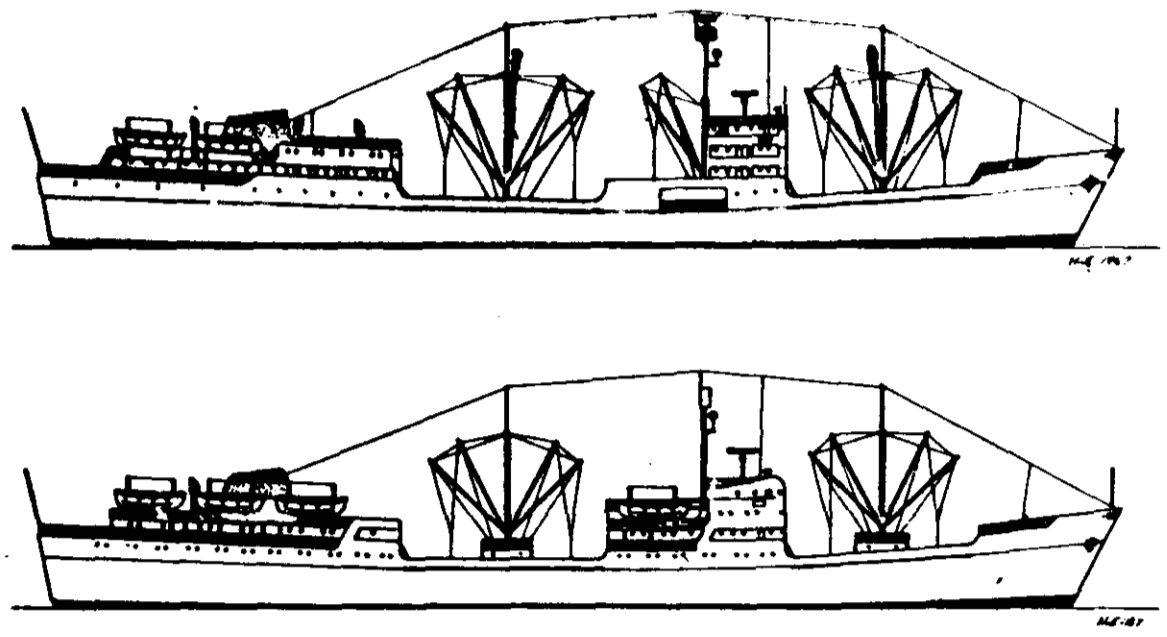
Type of Fishing Gear:
None.

Production Capacity:
This class of vessel can freeze 50 tons of fish per day. The fish are then stored in 3 holds that are held at -18°C (-0.4°F). The forward hold can be maintained at a lower temperature of -25°C (-13°F) if required. If the daily intake of fish exceeds the 50 ton maximum, 20 tons can be temporarily stored in ice in bunkers that are cooled to 0°C (32°F). The ship can produce about 12 tons of flake ice per day.

Remarks:
This vessel probably replaced the Bratsk class.

Pertinent References:
Kozyrchuk and Yusupov (1981), Krovanja (1984), Brady (1988)

FIGURE IX-5c



VESSEL TYPE: Refrigerated Transport — Freezer **VESSEL CLASS: Aktywbinsk (Serastopol)**

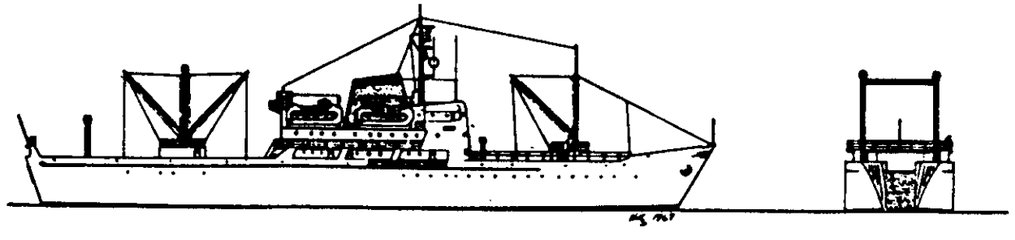
Length over all:	429-431' 130.9-131.5 m.	**Speed:**	16.5-17.5 knots
Beam:	54' 16.5 m.	**No. in crew:**	170
Draft:	Unknown	**Where built:**	USSR
Disp. tonnage (loaded-light):	8,970-10,250 tons	**When built:**	1956 - still building
Deadweight (metric tons):	4,142 tons	**No. built:**	Unknown
Gross tonnage:	5,525 tons	**Endurance:**	Unknown
Propulsion type:	Diesel - electric	**Hold capacity:**	190,699' 5,400 m.
Horsepower:	7,200	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
None.

Production Capacity:
This class of vessel can carry about 2,700 to 3,500 tons of frozen fish in refrigerated holds at -18°C (-0.4°F). She can freeze about 100 tons of fish per day in 8 air-blast freezing tunnels.

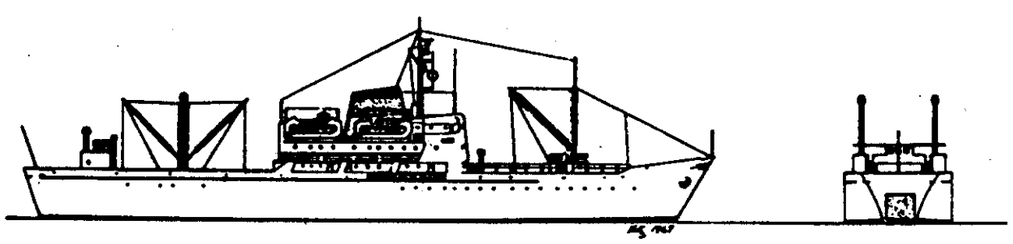
Remarks:
It is believed that there are two series in this class; the Aktybinsk which was built in 1956 and then the Sevastopols which were started in 1961. The Arseniv and Egershel'd are names of two of the Sevastopol series of ships.

Pertinent References:
Kan and Pavlov (1960), Kravanja (1964), Brady (1966).



VESSEL TYPE: Refrigerated Transport – Freezer

VESSEL CLASS: Skrypiar



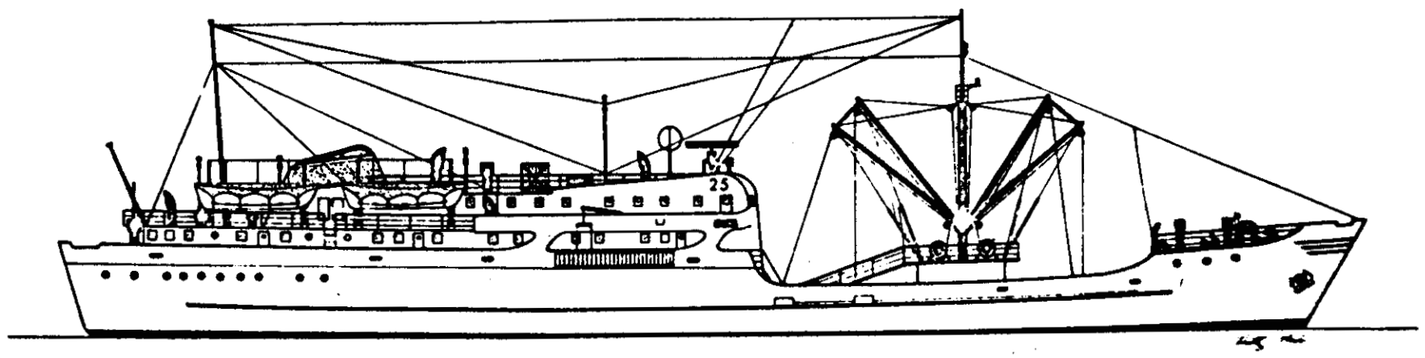
Length over all:	335-340' 102-103.6 m.	**Speed:**	11-14 knots
Beam:	52' 16.0 m.	**No. in crew:**	102
Draft:	17 5.2 m.	**Where built:**	Denmark and Holland
Disp. tonnage (loaded-light):	5,560 tons	**When built:**	1962 - still building
Deadweight (metric tons):	2,600-2,550 tons	**No. built:**	21 at the end of 1966
Gross tonnage:	4,699-5,019 tons	**Endurance:**	60 days
Propulsion type:	Diesel	**Hold capacity:**	129,070' 3,400 m.
Horsepower:	3,000-3,530	**Fuel capacity:**	60 tons 42,731' 1,210 m.

Type of Fishing Gear:
All three series of vessels can receive fish from catcher boats via the stern chute or side. Only the **Grumant** and **Rembrant** series can trawl. The size of trawl and doors used is unknown. The trawl winch has 2 drums, a pulling force of 15,000 kg. (33,069 lb.), and a drum capacity of 2,500 m. (8,202) of 27 mm. (1.06 inch) diameter cable.

Production Capacity:
This vessel can carry about 1,760 tons of fish products. In a day she can freeze 50 tons of fish and store them in refrigerated holds at -25°C (13.0°F), dehead and gut 10 tons of fish, chill or cool an additional 50 tons of fish for additional processing, process 30 tons of scraps into fish meal, convert 8½ tons of livers into oil, produce 10-20 tons of fresh water by distilling sea water, and make 10 tons of flake ice.

Remarks:
There are three series in this class: the **Skrypiar**, **Grumant**, and **Rembrant**. Basically they are all designed as freezer ships, that is to receive fish from catcher boats, but the last two series were designed to trawl. The first series consists of four ships: the **Skrypiar**, **Vitus Bering**, **Devydov**, and **Sovietsk**, that were built in Denmark between 1962 and 1963. The second series includes those ships built in Denmark since 1964. The names of some are **Grumant**, **Galfstrim**, **Skazachalk Anderson**, **Geizer**, **Gletcher**, **Zelenobersk**, **Zapaljarnyi**, **Pavlovo**, and **Prilluk**. The third series includes ships of this class built in Holland since 1964. The names of four are **Rembrant**, **Van Dijck**, **Frans Hals** and **Van Gogh**.

FIGURE IX-5d



VESSEL TYPE: Refrigerated Transport

VESSEL CLASS: Bratsk

Length over all:	270' 82.4 m.	**Speed:**	11 knots
Beam:	43' 13.0 m.	**No. in crew:**	91-82
Draft:	17' 5.1 m.	**Where built:**	East Germany (GDR)
Disp. tonnage (loaded-light):	2,495 tons	**When built:**	1959-1961
Deadweight (metric tons):	1,313 tons	**No. built:**	10
Gross tonnage:	2,500-2,295 tons	**Endurance:**	40 days
Propulsion type:	Diesel	**Hold capacity:**	63,566' 1,800 m.
Horsepower:	1,300	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

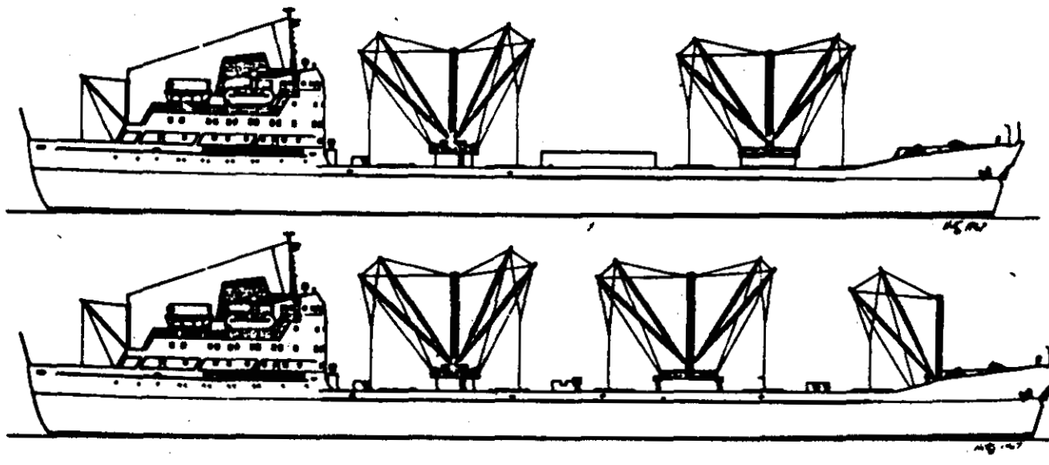
Type of Fishing Gear:
None.

Production Capacity:
This vessel can carry about 9,750 boxes of frozen fish or 645 tons in 3 holds that are held at -18°C (-0.4°F). She can freeze about 50 tons of fish per day.

Pertinent References:
Mekenitskii (1961), Kravanja (1964), Brady (1966), CFR 24(2) (Feb. 1962) p. 93.

FIGURE IX-6

FIGURE IX-6a



VESSEL TYPE: Refrigerated Transport

VESSEL CLASS: Priboy

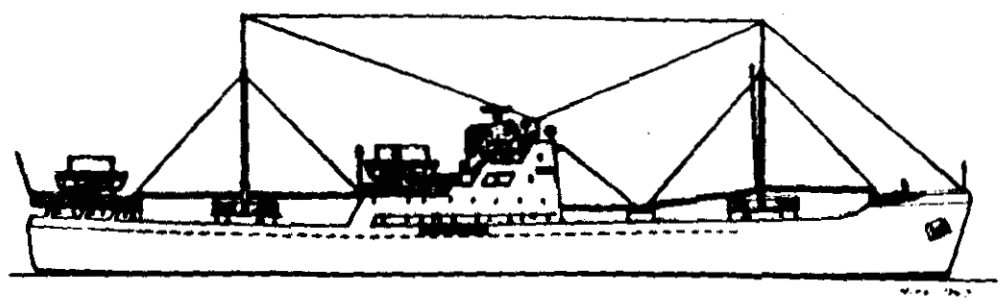
Length over all:	497-515' 151.5-157 m.	**Speed:**	17-17.5 knots
Beam:	67-69½' 20.5-21.2 m.	**No. in crew:**	81
Draft:	24' 7.3 m.	**Where built:**	Sweden
Disp. tonnage (loaded-light):	12,000 tons	**When built:**	1964-1965
Deadweight (metric tons):	8,000-7,800 tons	**No. built:**	10
Gross tonnage:	10,873-9,660 tons	**Endurance:**	Unknown
Propulsion type:	Diesel	**Hold capacity:**	441,434-450,091' 12,500-13,000 m.
Horsepower:	8,750	**Fuel capacity:**	(500 tons) 169,510' 4,800 m.
No. Screws:	1	**Fresh water capacity:**	10,241' 290 m.

Type of Fishing Gear:
None.

Production Capacity:
These vessels can carry about 7,250 tons of frozen fish in refrigerated holds that are held at a temperature of -30°C (-22°F). The vessels do not have processing equipment aboard but they can load about 1,000 tons of frozen fish per day.

Remarks:
Two series of ships were built; the larger **Priboy** series, which includes six ships: the **Priboy, Khibinskie Gory, Carl Linne, Lesnoskie Gory, Krymskie Gory,** and the **Uralskie Gory**; and the smaller **Kamchatskie Gory** series, which includes four ships: the **Kamchatskie Gory, Sahalinskie Gory, Sajanskie Gory,** and the **Altajskie Gory.**

Pertinent References:
CFR 26(11) 1964 p. 113, Terent'yer and Kamenskiy (1964), Brady (1966).



VESSEL TYPE: Refrigerated Transport

VESSEL CLASS: Yana (Sana)

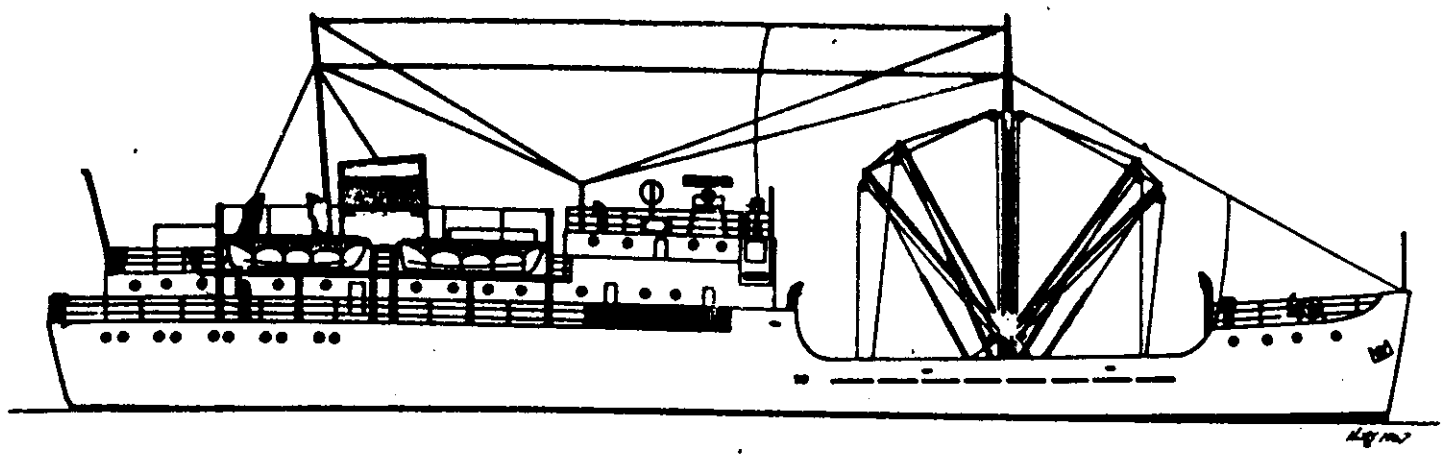
Length over all:	365' 111.3 m.	**Speed:**	14.5 knots
Beam:	48' 14.5 m.	**No. in crew:**	63-61
Draft:	19' 5.9 m.	**Where built:**	West Germany (GFR)
Disp. tonnage (loaded-light):	5,786 tons	**When built:**	1956
Deadweight (metric tons):	2,840 tons	**No. built:**	7
Gross tonnage:	3,782-3,790 tons	**Endurance**	45 days
Propulsion type:	Diesel	**Hold capacity:**	158,563' 4,490 m.
Horsepower:	3,120	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
None.

Production Capacity:
This vessel can carry up to 1,800 tons of frozen fish in holds that are held at -20°C (-4°F).

Remarks:
The names of six of these vessels are: **Jana, Indigirka, Umanj, Tuloma, Noman, and Konda.**

Pertinent References:
Brady (1966), Grzywaczewski et al (1964) Table 26, p. 116.



VESSEL TYPE: Refrigerated Transport
VESSEL CLASS: Refrigerator

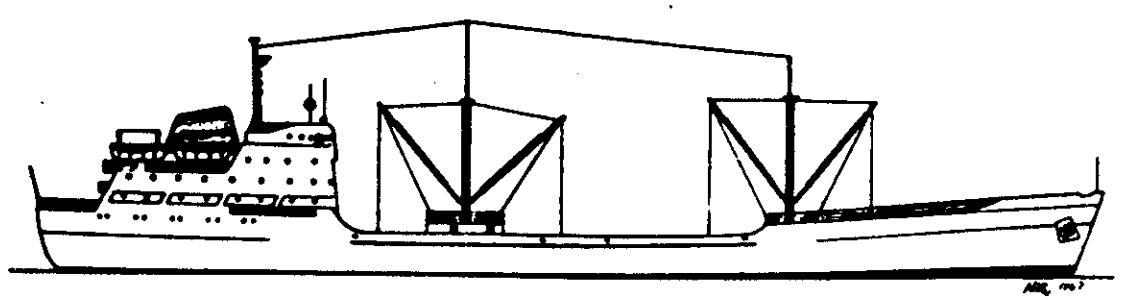
Length over all:	240' 73.2 m.	**Speed:**	10.7 knots
Beam:	38' 11.5 m.	**No. in crew:**	Unknown
Draft:	14' 4.2 m.	**Where built:**	Denmark
Disp. tonnage (loaded-light):	Unknown	**When built:**	1952-1956
Deadweight (metric tons):	Unknown	**No. built:**	10
Gross tonnage:	1,680-1,571 tons	**Endurance:**	Unknown
Propulsion type:	Probably diesel	**Hold capacity:**	Unknown
Horsepower:	1,000	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
None.

Production Capacity:
This class of vessel can freeze about 50 tons of whole fish per day. The fish are first machine-washed and then frozen in tunnels at -38°C (-22°F). The fish are then stored in refrigerated holds at -15°C to -18°C (5°F to -0.4°F).

Remarks:
The first five vessels built in this class were named Refrigerator 4, 5, 6, 7, and 8 and were delivered between 1952 and 1953. An additional nine vessels were delivered between 1955 and 1956 and their names were Refrigerator 9, 10, 11, 12, and 13, Gelendzhik, Samarkand, Genezavodsk, and Krasnogorsk.

Pertinent References:
Brady (1966), Kramheft and Schott (1954).



VESSEL TYPE: Refrigerated Transport **VESSEL CLASS:** Sibir

Length over all:	428' 130 m.	**Speed:**	Unknown
Beam:	55' 16.8 m.	**No. in crew:**	Unknown
Draft:	Unknown –	**Where built:**	USSR
Disp. tonnage (loaded-light):	9,700 tons	**When built:**	1963 - still building
Deadweight (metric tons):	5,285-4,905 tons	**No. built:**	Unknown
Gross tonnage:	6,133 tons	**Endurance:**	60 days
Propulsion type:	Diesel - electric	**Hold capacity:**	257,797' 7,300 m.
Horsepower:	4 (1,800) = 7,200	**Fuel capacity:**	Unknown
No. Screws:	1	**Fresh water capacity:**	Unknown

Type of Fishing Gear:
None.

Production Capacity:
No processing. Vessel receives frozen or chilled cargoes. She can handle 2,900 tons of frozen fish in cartons or 3,700 tons of salted herring.

Remarks:
The names of four of these ships are Sibir, Ivan Ayvozovskiy, Vasiliy Vereschagin, and Aleksei Vetslanov.

Pertinent References:
Terent'ev and Kamenskii (1964), Brady (1966).

FIGURE IX-6d

As for conservation, the Soviets have, on occasion, expressed concern for the rational utilization of the resources of the ocean.(32) They have entered into mutual bilateral agreements with the United States and Canada regarding gear conflicts and overfishing in the North Pacific, and cooperate with these countries through data exchanges and cooperative research investigations.(19)

No detailed account of Russian harvest from the Gulf of Alaska is available prior to the 1967-1969 period covered by bilateral agreement. Chitwood(29) has reported that the main fishery for groundfish in the Gulf of Alaska is for Pacific Ocean perch, with 230,000 and 240,000 tons taken in the years 1965 and 1966. Even for the 1967-1969 period, information on species composition of Russian trawl catches is not as detailed as the Japanese data. Table IX-6 gives the 1967-1969 catch breakdown by three categories: rockfish (Sebastas and Sebastodes), Pacific hake (Merluccius productus), and others. Hake and rockfish predominate, and there was a trend toward higher catches of hake in 1969. There are conspicuous differences in species composition of the catches between areas. The Aleutian Islands and Western and Eastern Gulf regions produce primarily rockfish, whereas in the British Columbia and Oregon-Washington areas, hake is the target species of the fishery. Information from the 1968 U.S.-U.S.S.R. Bilateral Scientific Meeting(33) indicates that the principal rockfish species in the Aleutians and Western Gulf is Pacific Ocean perch. However, in the eastern Gulf, a noticeable part of the catch consisted of blackmouth rockfish. Incidental species in the Aleutian and Gulf areas include pollock, black cod, arrowtooth flounder and miscellaneous flatfish.(20)

TABLE IX-5 - RUSSIAN TRAWLING HOURS IN THE GULF OF ALASKA FOR 1967-1969, BY YEAR, VESSEL TYPE, AREA AND QUARTERLY TOTALS(19)

		ALEUTIAN ISLANDS	WESTERN GULF	EASTERN GULF	BRITISH[a] COLUMBIA	OREGON-WASHINGTON	TOTAL	TOTAL ALL VESSELS
1967	SRT	545	8,088	2,294		15,417	26,344	95,122
	BMRT	12,642	7,157	34,656		14,323	68,778	(72%)
1968	SRT	2,479		2,336	518	677	6,090	42,979
	BMRT	5,828	5,965	4,393	7,110	13,593	36,889	(86%)
1969	SRT				350	1,144	1,494	32,701
	BMRT	5,170	3,147	125	9,700	13,065	31,207	(95%)
Total	SRT	3,024	8,088	4,630	948	17,238	33,928	170,802
	BMRT	23,640	16,269	39,174	16,810	40,981	136,874	
Quarter	1	842	9,369	12,224	1,502	1,340		
Quarter	2	11,777	4,085	11,529	2,838	21,732		
Quarter	3	10,626	4,482	9,569	13,928	19,999		
Quarter	4	3,419	6,421	10,482	642	16,488		

NOTE: See Figure 8 for areas.

[a]Combined with Eastern Gulf in 1967.

TABLE IX-6 - SOVIET CATCHES, IN METRIC TONS, AND PERCENT COMPOSITION BY AREA FOR 1967-1969(19)

		ALEUTIAN ISLANDS		WESTERN GULF		EASTERN GULF		BRITISH[a] COLUMBIA		OREGON-WASHINGTON		TOTAL	%
1967	Rockfish	46,570		44,473		28,587				19,845		139,475	43
	Hake					11,260				124,650		135,910	42
	Other	8,179		8,787		5,203				29,547		51,716	15
	Total	54,749		53,260		45,050				174,042		327,101	
1968	Rockfish	26,584		2,068		24,506		7,206		7,110		86,086	38
	Hake							35,804		63,821		99,625	44
	Other	8,630		9,000		5,226		11,025		7,080		40,961	18
	Total	35,214		29,680		29,732		54,035		78,011		226,672	
1969	Rockfish	23,172		18,159		665		1,607		2,241		45,844	21
	Hake							52,792		72,191		124,983	57
	Other	1,453		1,152		39		18,519		26,814		47,977	22
	Total	24,625		19,311		704		72,918		101,246		218,804	
			%		%		%		%		%		
Total	Rockfish	96,326	84	83,212	81	53,758	71	8,813	7	29,196	8	271,405	35
	Hake					1,126	15	88,596	70	26,062	74	360,518	47
	Other	18,262	16	18,939		10,468	14	29,544	23	63,441	18	140,654	18
	Total	114,588		102,251		75,486		126,953		353,299		772,577	
		15		13		8		16		46		7	

NOTE: See Figure 8 for areas.

[a]Combined with Eastern Gulf in 1967.

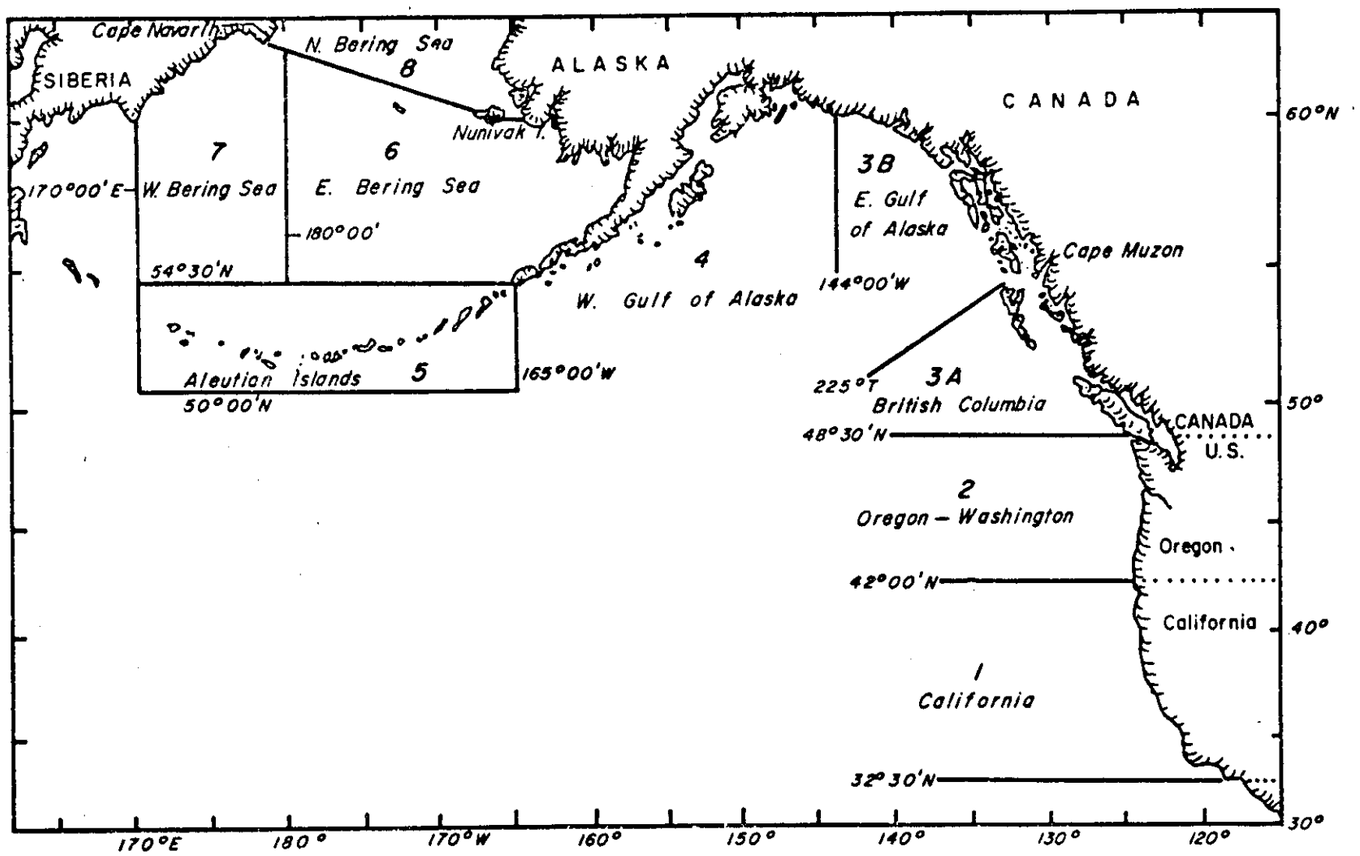


Figure IX-7 U.S.-U.S.S.R. Statistical Areas, 1968.

Shrimp

Foreign fleets operating in the Gulf of Alaska take considerable quantities of shrimp. Japan initiated the foreign fishery for shrimp off Alaska in 1961 in the central Bering Sea north of the Pribilof Islands.(29) The catch for that year totaled some 20.1 million pounds (Table IX-7), and reached a peak of about 71.1 million pounds in 1963. By 1966, the catch had declined to 6.1 million pounds in 1966, but rose again in 1968 to nearly 27 million pounds. Both side and stern trawlers have been used. The Japanese also have fished at a low level of intensity for shrimp in the Gulf of Alaska since 1963. Landings were less than from the Bering Sea with most of the catch taken in the Kodiak region.

Soviet distant-water-trawlers began fishing for shrimp north of the Pribilof Islands in 1963.(29)

TABLE IX-7 - PINK SHRIMP CATCH OF JAPANESE VESSELS IN ALASKA WATERS 1961-1968(24)

Year	Catch in Million Pounds Bering Sea	Gulf of Alaska
1961	30.1	---
1962	47.2	---
1963	71.1	1.4
1964	45.1	5.2
1965	19.5	0.2
1966	6.1	0.8
1967	7.2	0.5
1968	26.9	2.9

Halibut

With the continuing expansion of foreign fishing fleet activity throughout the range of the halibut fishery and with some increase in domestic trawling off British Columbia, it is evident that an impact on the resource is occurring. Halibut losses are diminishing the North American setline fleet's share of the benefits from the build-up of the resource to levels of maximum sustainable yield that were obtained in the early 1960's. These developments in the North Pacific can jeopardize the whole halibut program.(19)

It is currently estimated that, as of 1968, such losses in the yields available to the Canadian and United States setline fleets now probably approach a minimum of 10 million pounds annually.

While this estimate of unaccounted-for catches of halibut appear large, they are conservative when comparing the current situation in the Pacific halibut fishery with the decade of the 1930's. Today a much larger fleet of very large vessels fishes for many species, with a fishing strategy best described as "search and destroy."(19) Any sea surveillance or boarding is difficult, and effective search of large vessels is almost impossible. Shoreside surveillance is lacking. Also, with foreign fleets, there is practically no access to records for the detection of false or inconsistent fishing, purchase, sales or export data as was the case with the domestic halibut fleet in the 1930's.

There has also been a growing fleet of very large foreign setliners fishing primarily blackcod off southeastern Alaska, in the Gulf of Alaska and to a limited degree off British Columbia. These foreign activities south of Cape Spencer, coupled with the inadvertent catches of halibut by domestic trawlers, probably account for removals of at least 5 million pounds of halibut annually, based on extrapolating observations on the incidental taking of halibut in domestic fisheries.

On grounds west of Cape Spencer, the massive foreign trawl fishery for perch in the Gulf, pollock and yellowfin sole in the Bering Sea, coupled with other species, including shrimp, probably accounts for another 6 million pounds in the Gulf, including the Aleutian Chain.

To what degree the stocks may be able to absorb some of these added removals, particularly the losses at the juvenile stages, is a matter of great concern to the Halibut Commission and, in turn, to the North American Halibut fleets.(19)

Foreign Fishing Fleets

The following excerpts from the National Marine Fisheries Service, "Report on Foreign Fishing Off U.S. Coasts,"(35) for May and June, 1973, highlight recent foreign fishing activity in the Gulf of Alaska. See Figures IX-8 & IX-9.

"A total of 500 individual foreign fishing and fishery support vessels from Japan (403 vessels), the Soviet Union (87) and the Republic of Korea (10) engaged in fisheries off Alaska in May, 1973, an increase of 164 vessels from the previous month and 35 more vessels than in May, 1972.

"Soviet: The 87 individual Soviet vessels included 57 medium trawlers, 16 stern trawlers, 10 processing and transport vessels, 2 support vessels, and 2 research trawlers.

"The Soviet flounder fishery off Kodiak Island in the Gulf of Alaska, which had decreased steadily in the month of April, was terminated the first week of May. The effort for Pacific Ocean perch in the Gulf of Alaska was also terminated in early May. One Soviet stern trawler conducted fisheries research in the central and eastern Gulf of Alaska.

"Japanese: The 403 individual Japanese vessels off Alaska included 182 gillnet vessels, 119 medium trawlers, 32 stern trawlers, 32 crab pot vessels, 8 longliners, 28 processing and transport vessels, 1 research vessel, and 1 patrol vessel.

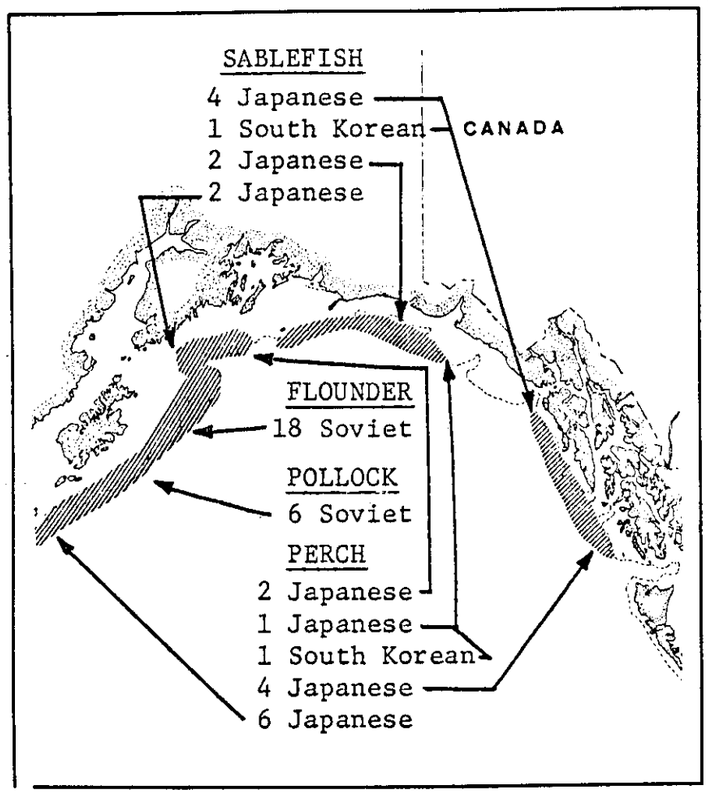
"The ocean perch fleet in the Gulf of Alaska decreased from 12 to 10 stern trawlers. Supported by one refrigerated transport vessel, the trawlers ranged widely in the Gulf, but their principal effort was between Kodiak and Shumagin Islands.

"Republic of Korea: Ten Korean vessels engaged in fisheries off Alaska in May. One longliner, which had been fishing sablefish off the coast of southeastern Alaska, left the Alaskan area by mid-May. The stern trawler which had been fishing for ocean perch in the eastern Gulf of Alaska also departed early in the month.

"A total of 653 individual vessels from Japan (579 vessels), the Soviet Union (62) and the Republic of Korea (2) engaged in fisheries off Alaska in June, 1973, an increase of 152 vessels over the number observed during May, 1973, and 31 more vessels than were seen in June, 1972.

"Soviet: The 62 individual Soviet vessels included 19 stern trawlers, 37 medium trawlers, 3 factory ships, and 3 refrigerated transports. The number of Soviet vessels present simultaneously decreased from 54 to 30 in early June and remained at that level the rest of the month. It is expected that the Soviet fleet will level off at about 25 vessels for the remainder of the summer.

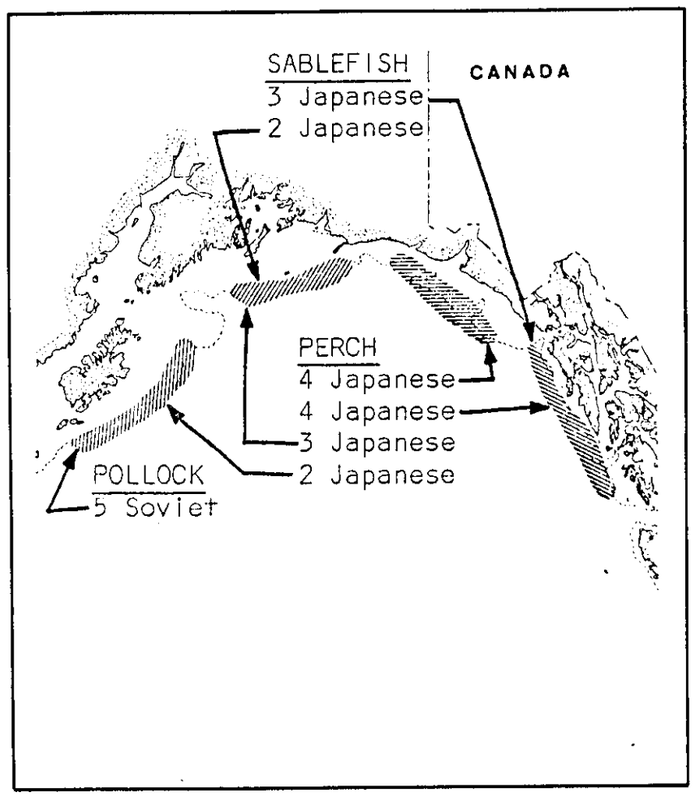
"A minor pollock fishery continued on Albatross Bank off Kodiak Island in the Gulf of Alaska. The fleet declined from 5 to 2 stern trawlers in mid-June.



Foreign fishing off Alaska in May 1973; by country, number of vessels, principal fishing grounds and species fished.

100 Fathom Curve------

Figure IX-8



Foreign fishing off Alaska in June 1973; by country, number of vessels, principal fishing grounds and species fished.

100 Fathom Curve------

Figure IX-9

"Japanese: The 579 Japanese vessels off Alaska included 43 stern trawlers, 111 medium trawlers, 332 salmon gillnetters, 15 herring gillnetters, 32 crab pot vessels, 8 longliners, 18 factory ships and 20 refrigerated transports. The number of ships present simultaneously increased from 388 in early June to 564 in late June.

"The ocean perch fleet in the Gulf of Alaska increased from 10 to 16 stern trawlers, serviced by one refrigerated transport. The fleet ranged from waters off southeastern Alaska to the Shumagin Islands. (See Figure 2.) The fishery for sablefish in the Gulf of Alaska was continued by 6 to 7 longliners scattered from southeast Alaska to the Shumagin Islands."

Data from the Food and Agriculture Organization of the United Nations relative to the Gulf of Alaska and the Bering Sea are shown in Tables IX-8, IX-9 and IX-10.[36] These data are from FAO Fishing Area 67, (Figure IX-10) which includes these two water masses (Table IX-11).[36] Gulf of Alaska harvest data are not specifically identified. However, the overall influence of Japanese and Russian fleet activity on fishery resources in this broad area, as contrasted with North American fishing accomplishment, is evident.

The areas fished by various foreign fleets for certain species in May and June, 1973, and December, 1974, are shown in Figure IX-8 and IX-9,[35] and IX-11[37].

PACIFIC NORTHEAST
Nominal catches, by countries
Thousand Pounds

TABLE IX-8

FAO FISHING AREA - 67

	1964	1965	1966	1967	1968	1969	1970	1971
TOTAL	3,262,808.0	3,218,716.0	3,681,682.0	4,210,786.0	4,254,878.0	4,828,074.0	5,820,144.0	4,585,568.0
Canada	726,415.7	659,593.3	600,092.1	353,627.8	288,582.1	194,004.8	257,056.3	247,135.6
Japan	680,119.1	761,027.9	1,021,391.1	1,899,483.3	2,242,739.5	2,545,210.7	3,079,826.2	2,164,476.2
USSR	1,140,880.5	1,049,610.0	1,198,420.5	1,254,637.8	957,457.7	1,417,116.8	1,648,158.9	1,446,217.6
United States	725,092.9	761,689.3	856,707.5	695,330.8	755,516.4	682,103.2	844,802.7	725,313.4

TABLE IX-9 - JAPAN FISHERIES CATCH IN THE BERING SEA AND GULF OF ALASKA (FAO AREA 67), IN THOUSAND POUNDS - 1969 - 1971

SPECIES	1971	1970	1969
Pacific Halibut	15,211.7	14,329.9	11,463.9
Arrowtooth Halibut	9,038.8	20,061.8	31,305.3
Flathead Sole	28,218.8	42,107.8	21,384.6
Yellowfin Sole	440.9	132,716.9	183,202.2
Rock Sole	22,927.8	18,739.1	9,700.2
Alaskan Plaice	162,258.5	20,723.2	13,448.0
Pacific Cod	49,162.5	127,866.8	96,561.4
North Pacific Hake	3,527.3	----------	----------
Alaskan Pollock	1,618,396.8	2,366,197.1	1,789,253.3
Pacific Ocean Perch	131,614.6	115,741.5	168,651.9
North Pacific Rockfish	881.8	5,731.9	1,984.1
Atka Mackerel	220.4	----------	----------
Sablefish	35,097.5	89,506.7	77,822.3
Various Demersal Percomorphs	14,991.2	----------	----------
Pacific Herring	10,582.0	54,894.5	74,515.4
Miscellaneous Finfish	----------	22,486.9	15,652.6
King Crab	----------	10,582.0	11,463.9
Queen Crab	11,904.8	38,139.5	38,800.9
FAO TOTAL	2,164,476.2	3,079,826.2	2,545,210.7

TABLE IX-10- USSR FISHERIES CATCH IN THE BERING SEA AND GULF OF ALASKA (FAO AREA 67), IN THOUSAND POUNDS - 1969 - 1971

SPECIES	1971	1970	1969
Pacific Halibut	4,721.6	57,540.0	50,264.8
Teleosteen plats (flounders)	257,717.7	215,609.8	211,862.0
Pacific Cod	157,628.9	109,568.6	25,352.9
North Pacific Hake	389,552.8	368,609.1	370,152.3
Alaska Pollock	130,071.4	54,012.7	93,915.9
Alfonsinos (Redfishes)	n.a.	17,857.2	19,620.9
Grunts	2,865.9	174,604.3	149,251.4
Pacific Ocean Perch	124,780.3	133,598.7	91,490.9
Atka Mackerel	33,950.8	24,911.9	33,730.3
Sablefish	10,361.6	14,550.3	21,605.0
Various Demersal Percomorphs	55,335.4	48,501.2	18,077.7
Pacific Herring	62,169.7	258,379.1	162,479.0
Miscellaneous fish	136,464.7	127,646.3	113,316.4
King Crab	13,007.1	15,873.1	19,841.4
Miscellaneous Crustaceans[1/]	9,700.2	15,652.6	28,218.8
Miscellaneous Molluscs	13,888.9	11,243.4	7,936.5
FAO TOTAL	1,446,217.6	1,648,158.9	1,417,116.8

[1/] Mainly shrimp

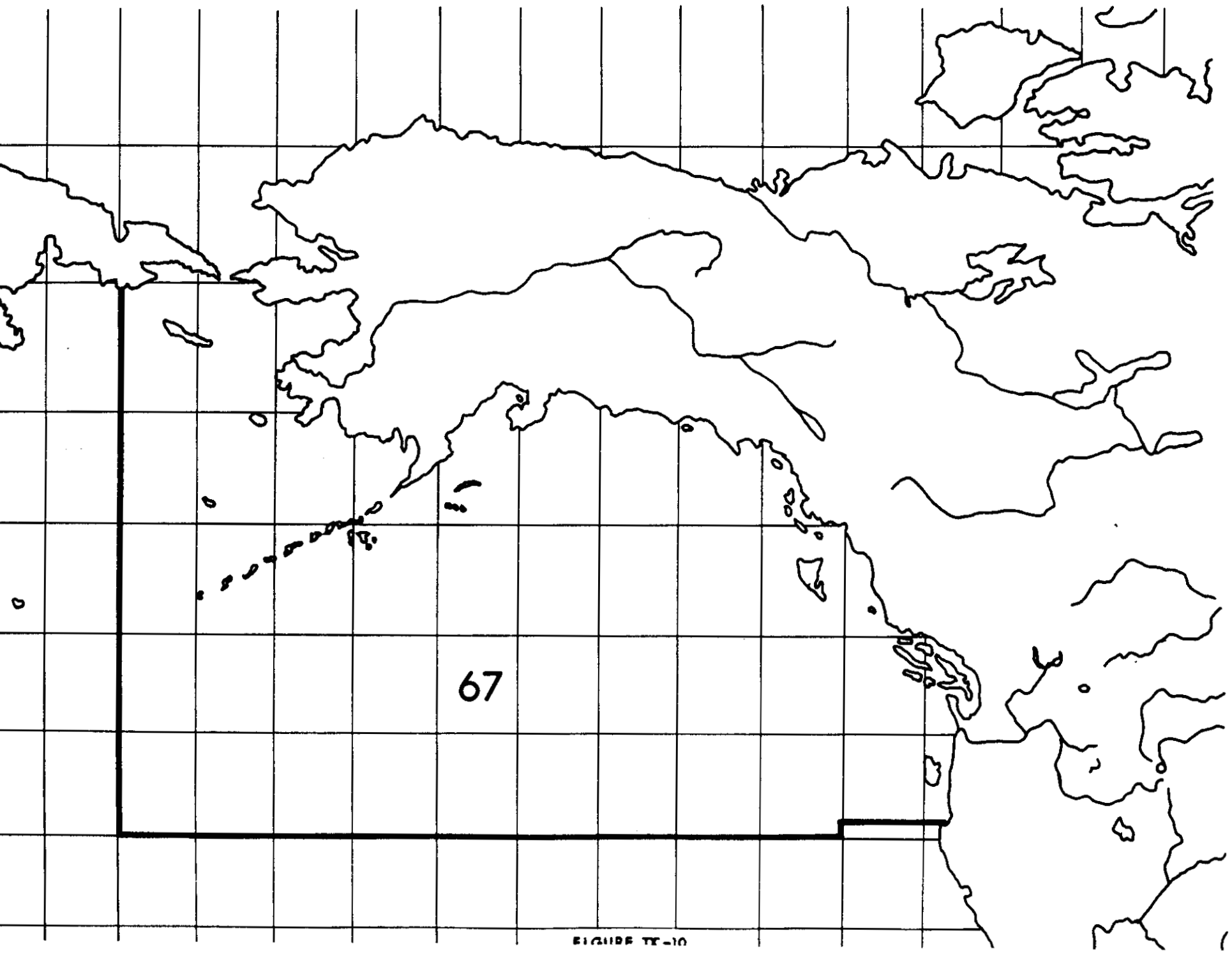


FIGURE TF-10

TABLE IX-11

FOREIGN FISHERY VESSELS OPERATING OFF ALASKA
JULY, 1972, THROUGH JUNE, 1973
(EXCLUDING DUPLICATE SIGHTINGS) - BY TYPE OF VESSEL AND COUNTRY

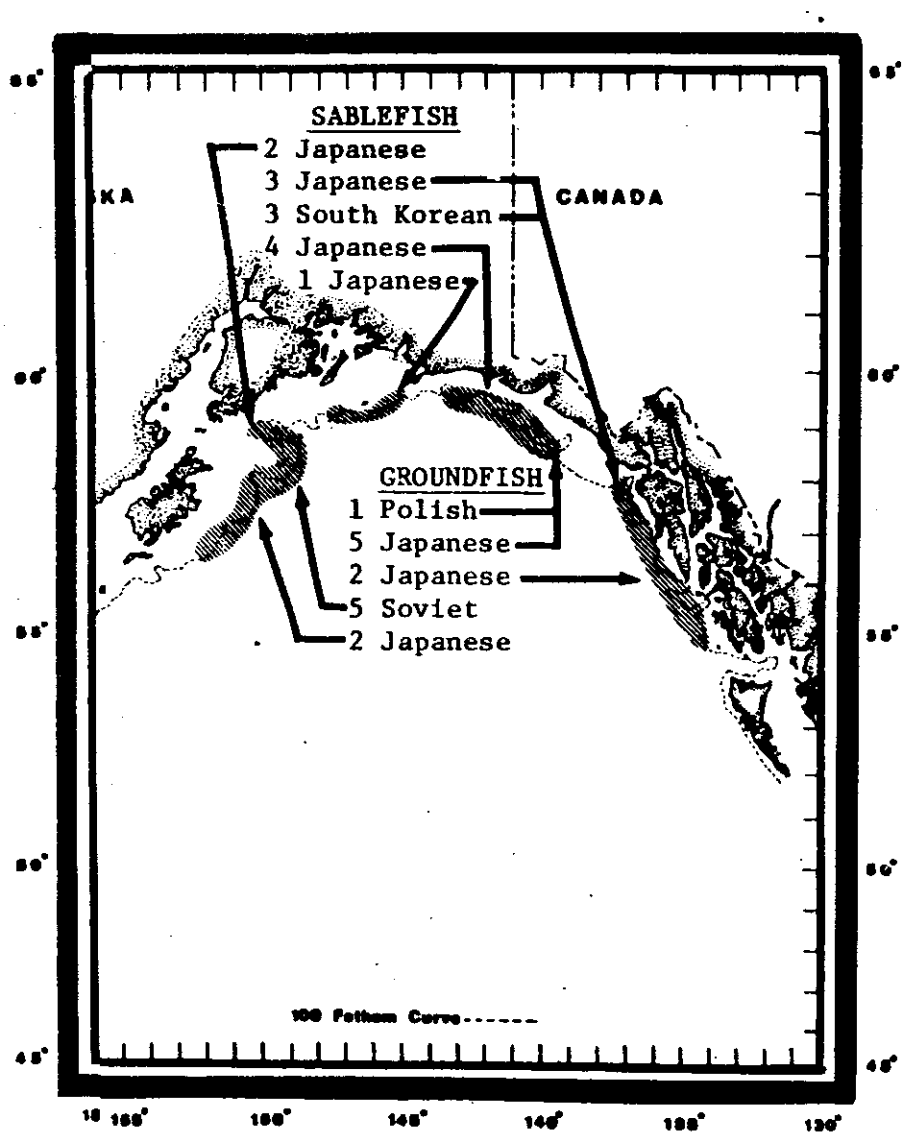
OFF ALASKA		Stern[1] Trawlers	Medium[2] Trawlers	Other Fishing Vessels	Process & Transport Vessels	Subport[3] Vessels	Research[4] Vessels	TOTAL
July, 1972	Japan	39	105	290	36	---	---	470
	Soviet Union	15	14	---	1	---	---	30
	Rep. of Korea	4	---	---	---	---	---	4
	Total	58	119	290	37	---	---	504
August, 1972	Japan	47	105	53	22	1	---	228
	Soviet Union	15	18	---	1	1	1	35
	Rep. of Korea	2	---	---	---	---	---	2
	Total	64	123	53	23	2	1	265
September, 1972	Japan	46	120	54	21	1	---	242
	Soviet Union	6	16	---	1	---	2	25
	Rep. of Korea	2	---	---	---	---	---	2
	Total	54	136	54	22	1	2	269
October, 1972	Japan	36	39	10	11	---	---	96
	Soviet Union	9	16	---	2	---	---	27
	Rep. of Korea	---	---	---	---	---	---	---
	Total	45	55	10	13	---	---	123
November, 1972	Japan	23	17	10	7	---	---	57
	Soviet Union	14	21	---	2	---	---	37
	Rep. of Korea	---	---	---	---	---	---	---
	Total	37	38	10	9	---	---	94
December, 1972	Japan	29	17	10	9	2	---	67
	Soviet Union	6	44	---	5	1	3	59
	Rep. of Korea	---	---	---	---	---	---	---
	Total	35	61	10	14	3	3	126

1/ Includes all classes of stern factory and stern freezer trawlers.
2/ Includes all classes of medium side trawlers (non-refrigerated, refrigerated and freezer trawlers).
3/ Includes fuel and water carriers, tugs, cargo vessels, etc.
4/ Includes exploratory, research and enforcement (F) vessels.

TABLE IX-11 (CONT.)
FOREIGN FISHERY VESSELS OPERATING OFF ALASKA (CONT'D)

OFF ALASKA		Stern[1] Trawlers	Medium[2] Trawlers	Other Fishing Vessels	Process & Transport Vessels	Subport[3] Vessels	Research[4] Vessels	TOTAL
January, 1973	Japan	34	10	9	5	1	---	59
	Soviet Union	16	83	---	11	1	2	113
	Rep. of Korea	---	---	---	---	---	---	---
	Total	50	93	9	16	2	2	172
February, 1973	Japan	29	8	11	6	---	1	55
	Soviet Union	23	67	---	14	5	8	117
	Rep. of Korea	1	---	---	---	---	---	1
	Total	53	75	11	20	5	9	173
March, 1973	Japan	32	102	41	20	2	---	197
	Soviet Union	25	79	---	13	5	2	124
	Rep. of Korea	1	---	1	---	---	---	2
	Total	58	181	42	33	7	2	323
April, 1973	Japan	35	94	41	17	1	---	188
	Soviet Union	41	79	---	15	7	4	146
	Rep. of Korea	1	---	1	---	---	---	2
	Total	77	173	42	32	8	4	336
May, 1973	Japan	32	119	222	28	---	2	403
	Soviet Union	16	57	---	10	2	2	87
	Rep. of Korea	3	4	1	2	---	---	10
	Total	51	180	223	40	2	4	500
June, 1973	Japan	43	111	387	38	---	---	579
	Soviet Union	19	37	---	6	---	---	62
	Rep. of Korea	2	8	---	2	---	---	12
	Total	64	156	387	46	---	---	653

1/ Includes all classes of stern factory and stern freezer trawlers.
2/ Includes all classes of medium side trawlers (non-refrigerated, refrigerated and freezer trawlers).
3/ Includes fuel and water carriers, tugs, cargo vessels, etc.
4/ Includes exploratory, research and enforcement (E) vessels.



Foreign fishing off Alaska in December 1974, by country, number of vessels, principal fishing grounds and species fished.

FIGURE IX-11

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